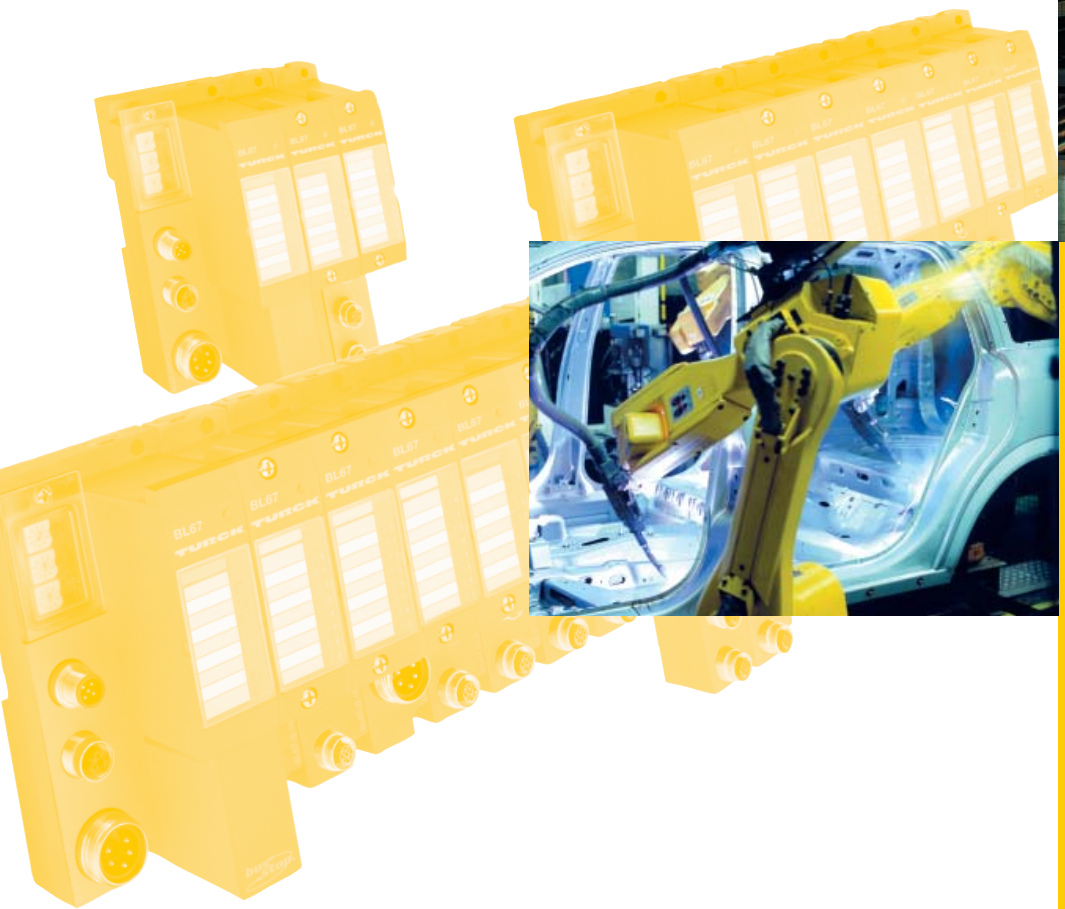
TURCK

Industrial
Automation

USER MANUAL

BL67 - I/O MODULES



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1.1 Documentation concept

This manual contains all information about the bus-independent I/O-modules for the modular TURCK I/O system BL67.

The following chapters contain a short system description of BL67, the exact function description for the I/O-modules, as well as all general information concerning the whole system as for example mounting/dismounting, labeling etc.

In addition to that, the manual contains a short description of the I/O-ASSISTANT, the project planning and configuration software tool for TURCK I/O-systems, the software I/O-ASSISTANT.

The bus-specific BL67-gateways, the connection to the different automation devices, the maximum system extension as well as all other bus specific information are described in separate manuals.

1.2 Explanation of symbols

Warnings

Action-related warnings are placed next to potentially dangerous work steps and are marked by graphic symbols. Each warning is initiated by a warning sign and a signal word that expresses the gravity of the danger. The warnings have absolutely to be observed.

DANGER!

DANGER indicates an immediately dangerous situation, with high risk, the death or severe injury, if not avoided.

WARNING!

WARNING indicates a potentially dangerous situation with medium risk, the death or severe injury, if not avoided.

CAUTION!

CAUTION indicates a potentially dangerous situation with low risk, middle or low injury, if not avoided.

ATTENTION!

ATTENTION indicates a situation that may lead to property damage, if it is not avoided.

1.2.1 Further notes

NOTE

In NOTES you find tips, recommendations and important information. The notes facilitate work, provide more information on specific actions and help to avoid overtime by not following the correct procedure.

TECHNICAL BASICS

The TECHNICAL BASICS offer technical information, basics and background information. This information lead to a better understanding of the device functions for example. The experienced user can skip this information.

➤ CALL TO ACTION

This symbol identifies steps that the user has to perform.

➥ RESULTS OF ACTION

This symbol identifies relevant results of steps

1.3 General notes

Please read this section carefully. Safety aspects cannot be left to chance when dealing with electrical equipment.

This manual includes all information necessary for the prescribed use of the BL67-products. It has been specially conceived for personnel with the necessary qualifications.

1.3.1 Prescribed use

The devices described in this manual must be used only in applications prescribed in this manual or in the respective technical descriptions, and only with certified components and devices from third party manufacturers.

Appropriate transport, storage, deployment and mounting as well as careful operating and thorough maintenance guarantee the trouble-free and safe operation of these devices.

1.3.2 Notes concerning planning/installation of this product

All respective safety measures and accident protection guidelines must be considered carefully and without exception.

1.4 List of revisions

In comparison to the previous manual edition, the following changes/revisions have been made.

Table 1-1: List of revisions

Chapter	Issue/description	new	changed
Chap. 4 to 10	Process data mapping	X	
	Diagnostic data		X
	Module parameters		X

NOTE

The publication of this manual renders all previous editions invalid.

2 BL67-philosophy

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2.1 The basic concept

BL67 is a modular IP67 I/O-system for use in industrial automation. It connects the sensors and actuators in the field to the higher-level controller.

BL67 offers modules for practically all applications:

- Digital input and output modules
- Analog input and output modules
- Technology modules (RS232 interface, …)

A complete BL67 station counts as **one** station on the bus and therefore occupies **one** fieldbus address in any given fieldbus structure.
A BL67 station consists of a gateway, power distribution modules and I/O modules.

The connection to the relevant fieldbus is made via the bus-specific gateway, which is responsible for the communication between the BL67 station and the other fieldbus stations.

The communication within the BL67 station between the gateway and the individual BL67 modules is regulated via an internal module bus.

NOTE

The gateway is the only fieldbus-dependent module on a BL67 station. All other BL67 modules are not dependent on the fieldbus used.

2.1.1 Flexibility

A BL67 station can contain modules in any combination, which means it is possible to adapt the system to practically all applications in automated industry.

2.1.2 Convenient handling

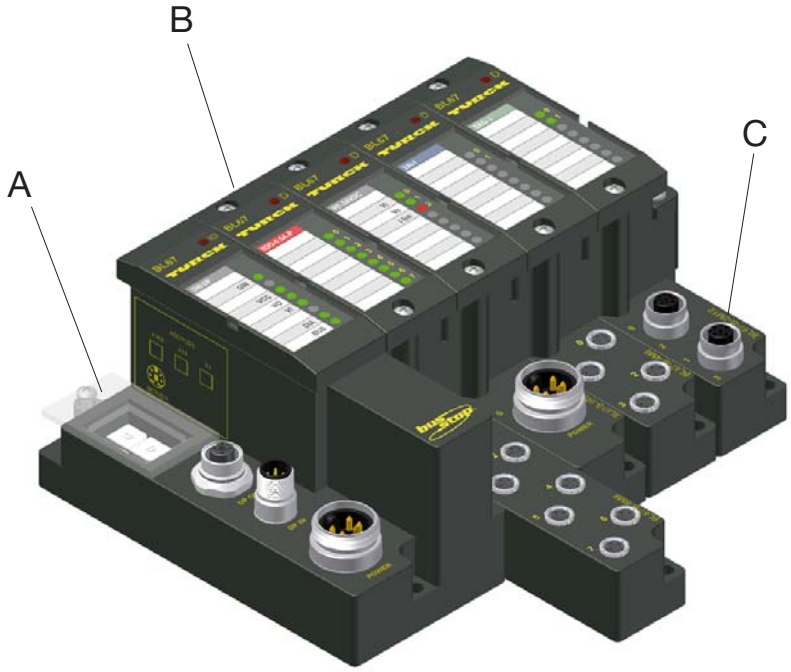
All BL67 modules, with the exception of the gateway, consist of a base module and an electronic module.
The gateway and the base modules are snapped onto a mounting rail or are directly mounted onto a mounting plate. The electronic modules are plugged onto the appropriate base modules.

After disconnection of the load, the electronic modules can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

2.2 BL67 components

Figure 2-1: BL67 station PROFIBUS-DP

A *PBDP-gateway*
B *electronic module*
C *Base module*



Gateway

The gateway connects the fieldbus to the I/O modules. It is responsible for handling the entire process data and generates diagnostic information for the higher-level master and the software tool I/O-ASSISTANT (PACTware™ + BL67-DTM).

Figure 2-2: BL67 gateway for PROFIBUS-DP

2.2.1 Electronics modules

Electronic modules contain the I/O-functions of the BL67 modules (Power Feeding modules, digital and analog input/output modules and technology modules).

Electronic modules are plugged onto the base modules and are not directly connected to the wiring. They can be plugged or pulled when the station is being commissioned or for maintenance purposes, without having to disconnect the field wiring from the base modules.

Figure 2-3: Example for an electronic module

Power Feeding modules

They are necessary when groups of modules with different potentials are planned within a BL67 station, or if the rated supply voltage of 24 V DC for the BL67 modules cannot be guaranteed.

The adjoining power supply module and modules to the left are potentially isolated.

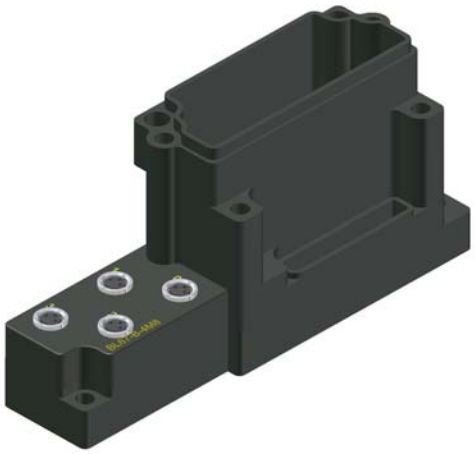
2.2.2 Base modules

The field wiring is connected to the base modules.

These are available in miscellaneous connection variations:

- 1 x M12, 2 x M12, 2 x M12-P, 4 x M12, 4 x M12-P
- 4 x M8, 8 x M8
- 1 x M12-8
- 1 x 7/8'' (for Power Feeding modules) etc.

Figure 2-4: Example for a base module



2.2.3 End plate

An end plate on the right-hand side physically completes the BL67 station.

It protects the module bus contacts of the last base module in a station and guarantees the protection class IP67 when tightly screwed.

Figure 2-5: End plate

3 General technical Data of BL67 modules

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3.1 General

This chapter describes the general information and technical data valid for the whole system.

The following chapters (chapter 3 to chapter 9) contain all information about the function and the structure of BL67 I/O-, power supply and base modules as well as all module specific technical data.

NOTE

The gateway's technical data, diagnostic data and parameterization options are described in the bus-specific manuals for the gateways.

3.2 Module abbreviations

The module designations are explained in the following table:

Table 3-1: Module abbreviations

Abbr.	Designation	Example
AI	Analog input module	BL67-2**AI**-I
AO	Analog output module	BL67-2**AO**-V
B	Designation for the base modules.	BL67-**B**-2M12
DP	PROFIBUS-DP	BL67-GW-**DP**
I	Analog in- or output module for current signals	BL67-2AO-**I**
P	Positive switching (sourcing)	BL67-8DO-0.5A-**P**
PF	Power feeding module	BL67-**PF**-24VDC
PT	Analog input module for connecting resistance thermometers in 2- or 3-wire measurement type	BL67-2AI-**PT**
RS232	Module with integrated RS232 interface	BL67-1**RS232**
TC	Analog input module for connecting thermocouples	BL67-2AI-**TC**
V	Analog in- or output module for the measurement or the output of voltage signals	BL67-2AO-**V**

3.3 Technical abbreviations

The following abbreviations are used in the technical data and wiring diagrams:

Table 3-2: Technical abbreviations

Abbr.	Designation
f_T	Transmission frequency
I_A	Output current
I_{Amax}	Maximum output current
I_{in}	Input current
I_K	Short-circuit current
I_L	Nominal current consumption from power supply (field)
I_{MAX}	Maximum Input current (destruction limit)
I_{MB}	Nominal current consumption from the module bus (5 V DC)
I_{SENS}	Sensor supply from V_{sens}
PE	Protective earth
P_{MAX}	Maximum power loss of the module
R_E	Input resistance
R_{LI}	Load impedance, inductive
R_{LK}	Load impedance, resistive
R_{LL}	Lamp load
R_{LO}	Resistive load
R_{ON}	Switch-on resistance
$t_{Ambient}$	Ambient temperature
T_K	Temperature coefficient
t_{Store}	Storage temperature
U_{Fe}	Isolation voltage (field/functional earth)
U_{MAX}	Maximum input voltage (destruction limit)
U_{TMB}	Isolation voltage (module bus/field)
V_i/U_B	Supply voltage for inputs/operating voltage
V_o/U_L	Supply voltage for outputs/load voltage
V_{sens}	Sensor supply

3.4 Station dimensions

Figure 3-1: Top view

A *dimensions in mm [inch]*

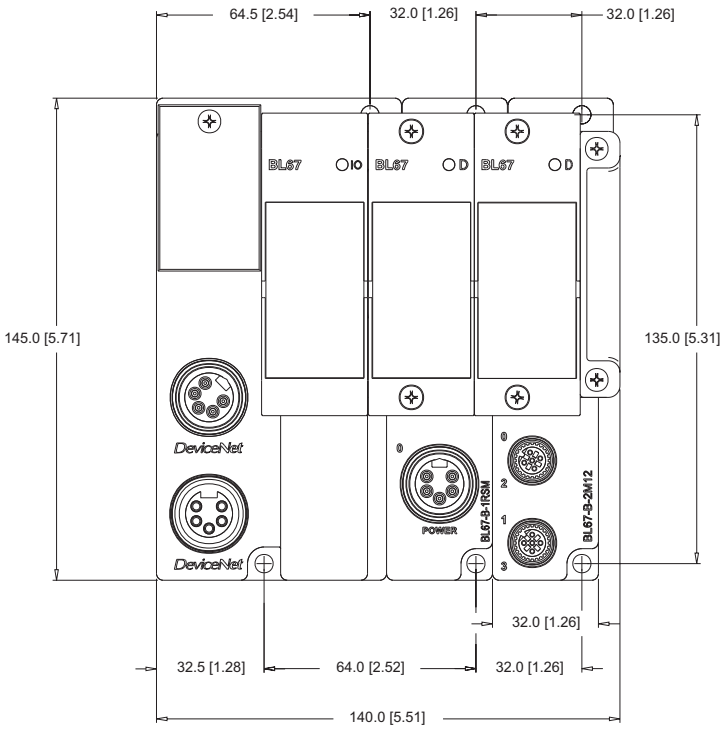
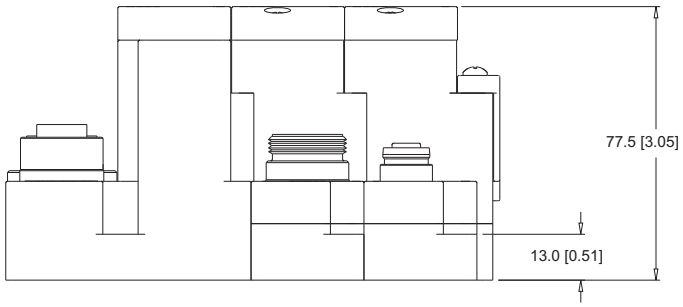


Figure 3-2: Side view

A *dimensions in mm [inch]*



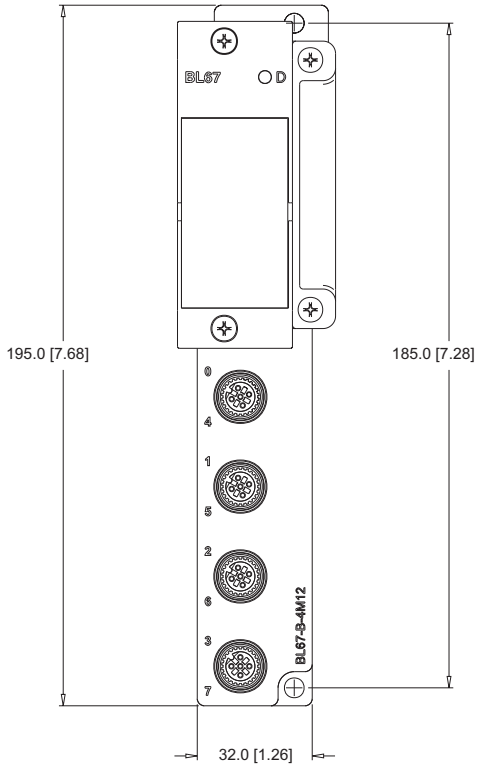


Figure 3-3: BL67-module (electronic - and base module)

A *dimensions in mm [inch]*

3.5 General technical data

ATTENTION!

Disregarding the SELV-range

Destruction of components

➤ The auxiliary power supply must comply with the stipulations of SELV (Safety Extra Low Voltage) according to IEC 60364-4-41.

Table 3-3: General technical data

Supply voltage/auxiliary voltage	
Demands on the voltage supply acc. to EN 61131-2	
Nominal value (provision for other modules)	24 VDC
Permissible range	according to EN 61131 -2 18 to 30 VDC
Residual ripple	according to EN 61131-2
Potential isolation	yes, via opto-coupler
Isolation voltages	
– Fieldbus/(V_I/V_O)	– PROFIBUS-DP: 500 V_{eff} – DeviceNet™: none – Ethernet: 500 V_{eff}
– V_I/V_O	none
– (V_I/V_O**1**)/(V_I/V_O**2**), with PF module for potential isolation	500 V_{eff}
– Fieldbus/(V_I/V_O**2**)	500 V_{eff}
Ambient conditions	
Ambient temperature	
– $t_{Ambient}$	0 to +55 °C/32 to 131 °F
– t_{Store}	-25 to +85 °C/-13 to 185 °F
Relative humidity	according to IEC 61131 -2
Climatic tests	according to EN 61131 -2
Noxious gas	according to IEC 68068-42/43
Resistance to vibration	according to IEC 61131 -2
Protection class	according to IEC 60529 IP67
Shock resistant	according to IEC 61131 -2
Topple and fall/free fall	according to IEC 61131 -2
Emitted interference	
High-frequency, radiated	according to EN 55011, Class A
Immunity to interference	

	Static electricity	according to IEC 61131 -2
	Electromagnetic HF fields	according to IEC 61131 -2
	Fast transients (Burst)	according to IEC 61131 -2
	Conducted interferences induced by HF fields	according to IEC 61000-4-6 10 V Criteria A
A *I/O-line-length≤ 30 m*	High energy transients (Surge) **A** Voltage range	according to IEC 61000-4-5 0,5 kV CM, 12Ω/ 9 µF 0,5 kV DM, 2Ω/ 18 µF Criteria B
	Reliability	
		min. 120000 h
	Pull/plug cycles of electronic modules	20

NOTE

This device can cause radio disturbances in residential areas and in small industrial areas (residential, business and trading). In this case, the operator can be required to take appropriate measures to suppress the disturbance at his own cost.

3.6 Approvals

Table 3-4: Approvals

Approvals
CE
CSA
UL

4 Power feeding modules

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4.1.1 Module overview 2

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4.1 Overview

Power Feeding modules supply an galvanically isolated 24 V DC field voltage to the I/O modules.

By using Power Feeding modules, it is not necessary to distribute power separately to each BL67 I/O module.

Power Feeding modules distribute two separately switchable voltages to the modules, one for the inputs (V_{sens}), and one for the outputs (V_O). These two voltages refer to the same ground potential (GND).

A sensor current limitation of 4 A for the input supply V_{sens} is integrated in the modules to detect possible short circuits in the sensor supply.

The 24 V DC field supply is connected to the Power Feeding module by a 7/8"- connector.

LED displays

Error signals and diagnostic statuses are indicated via LEDs on the module. The corresponding diagnostic information is transmitted to the gateway via diagnostic bits.

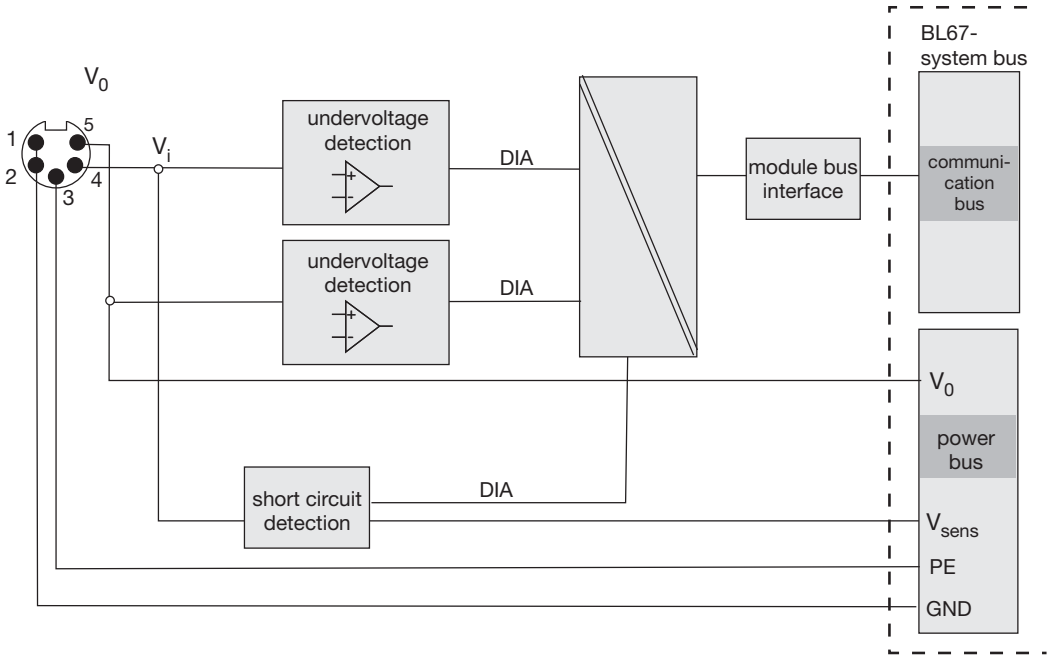
4.1.1 Module overview

- BL67-PF-24VDC

4.2 BL67-PF-24VDC, with diagnostics

Figure 4-1:
BL67-PF-24VDC

Figure 4-2:
Block diagram



4.2.1 Technical data

Table 4-1: Technical data

Designation	BL67-PF-24VDC
field supply	
V_O	24 VDC
V_I	24 VDC
Permissible range	18 to 30 V
I_{MB} Nominal current from 5 V DC (module bus)	≤ 30 mA
Max. output current from V_O	10 A
max sensor supply I_{sens}	4 A (limited by internal current limiter)
Isolation voltage module bus/ supply voltage	max. 1000 VDC

4.2.2 Diagnostic and status messages

LED status displays

Table 4-2: LED status displays

LED	Display	Meaning	Remedy
D	red, flashing, 0.5 Hz	Diagnostics pending	–
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–
V_O	Green	Power supply for outputs OK	–
	OFF	Power supply for outputs faulty	– Check the wiring to the power supply. – Check the external power supply unit.
V_I	Green	Power supply for inputs OK	–
	OFF	Power supply for inputs faulty	– Check the wiring to the power supply. – Check the external power supply unit.
I_{lim}	Red	Short circuit in sensor supply (V_{sens})	– Check the sensor supply.
	OFF	Sensor supply OK	-

Diagnostic data

This module has the following diagnostic data per channel:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	Overcurrent I_I	Undervoltage V_O	Undervoltage V_I

Table 4-3: Diagnostics

Diagnostics	Meaning
Overcurrent I_I	Current consumption too high (> 4 A).
Undervoltage V_O	V_O < 18 VDC
Undervoltage V_I	Sensor supply V_O < 18 V

4.2.3 Module parameters

none

4.2.4 Base modules/pin assignment

- BL67-B-1RSM (7/8'')/BL67-B-1RSM-4/BL67-B-1RSM-VO

Figure 4-3: BL67-B-1RSM/ BL67-B-1RSM-4/ BL67-B-1RSM-VO

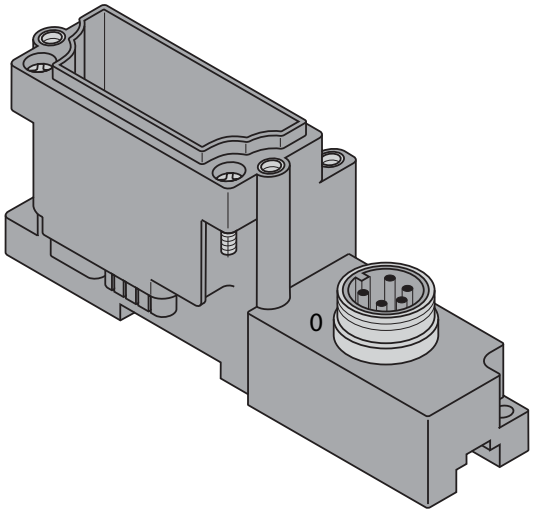
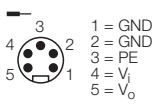


Figure 4-4: Pin assignment BL67-PF-24VDC with BL67-B-1RSM



module wiring diagram

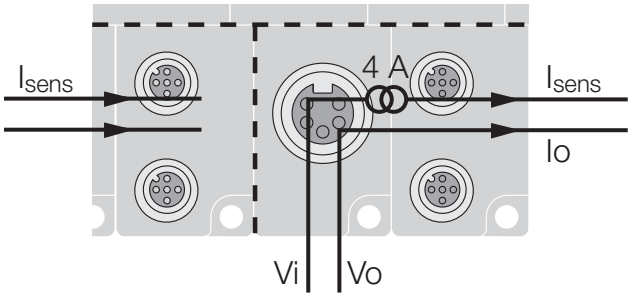
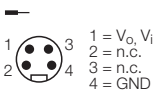


Figure 4-5: Pin assignment BL67-PF-24VDC with BL67-B-1RSM-4



Total current (I_{sens} + I_O) max. 10 A

module wiring diagram

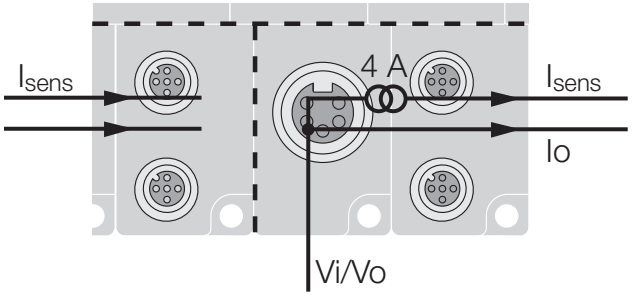
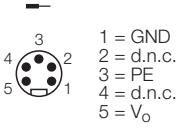
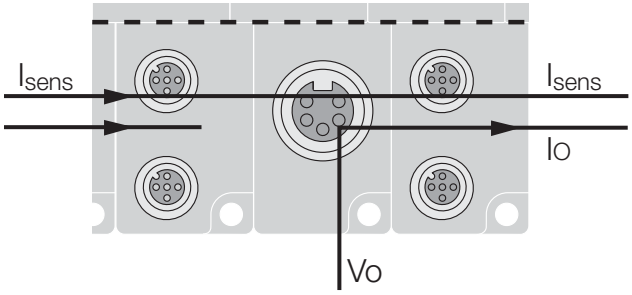


Figure 4-6: Pin assignment BL67-PF-24VDC with BL67-B-1RSM-VO



Only V_O (pin 1 and 5) supply, do not connect pin 2 and 4!

module wiring diagram



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5.1 Overview

Digital input modules (DI) detect electrical high- and low-level values through the base module connections and transmit the corresponding digital value to the gateway via the module bus.

The modules provide optically isolated inputs according to IEC 61131 Type 1.

The sensor supply (V_{sens}) is tapped from the internal voltage supply bus.

This voltage is supplied by the gateway or a Power Feeding module. Both contain a short circuit detection for the sensor supply voltage.

In the modules without diagnostic function a sensor short circuit is thus detected in the gateway or in the Power Feeding module.

The modules with diagnostic function (BL67-xDI-**PD**) provide a short circuit protection.

The modules provide reverse polarity protection.

LED displays

- modules without channel- or connector-diagnosis:
  Channel statuses are indicated by LEDs. Error signals from the I/O level are indicated by each module via the "D" LED.
- modules with channel- or connector-diagnosis:
  The modules BL67-xDI-**PD** provide whether a channel- or a connector diagnosis function. Diagnosis information are indicated via the channel LED or via the "D" LED.

5.1.1 Module overview

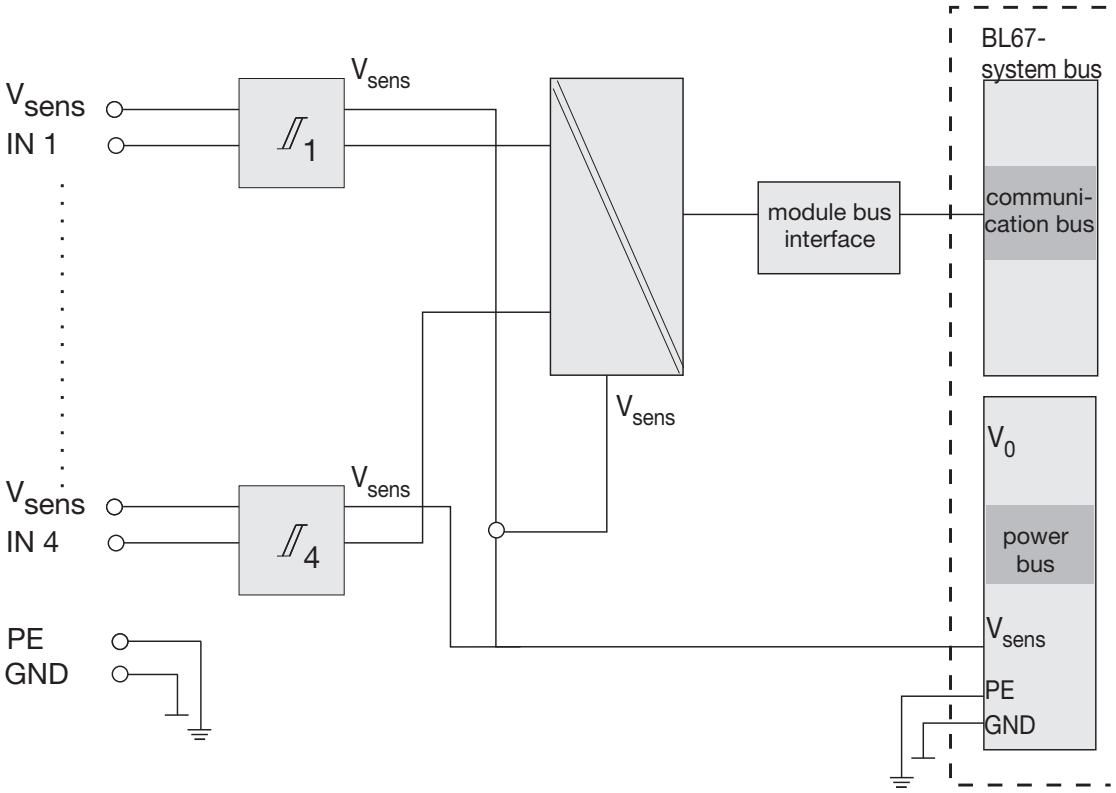
Table 5-1: Module overview

Module	No. of channels	Positive switching
BL67-4DI-P	4	✓
BL67-8DI-P	8	✓
BL67-4DI-N	4	-
BL67-8DI-N	8	-
BL67-4DI-PD	4	✓
BL67-8DI-PD	8	✓
BL67-16DI-P	16	✓

5.2 BL67-4DI-P

Figure 5-1:
BL67-4DI-P

Figure 5-2:
Block diagram



5.2.1 Technical data

Table 5-2: Technical data

Designation	BL67-4DI-P
No. of channels	4
Input voltage V_{sens} at nominal value 24 VDC	
Low level	< 4,5 V
High level	> 7 V (max. 30 V)
Nominal current consumption at 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	≤ 40 mA
Power loss of the module	< 250 mW
Input current I_{in}	
Low level	< 0,5 mA
High level	> 3.7 mA
Input delay	
t_{ON}	< 250 µs
t_{OFF}	< 250 µs
Isolation voltage	
U_{TMB} (module bus/field)	max. 1000 VDC

5.2.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	-	-	-	-	DI3	DI2	DI1	DI0

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 5-3: Process data bits

Process data	value	Meaning
DIx	0	Digital input inactive
	1	Digital input active

5.2.3 Diagnostic and status messages

LED status displays

Table 5-4: LED status displays

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages	–
0 to 3	Green	Status of channel x = "1"	–
	OFF	Status of channel x = "0"	-

NOTE

The numbering of the channel LEDs corresponds to the channel numbering.

5.2.4 Module parameters

none

5.2.5 Base modules/pin assignment

- BL67-B-4M8

Figure 5-3: BL67-B-4M8

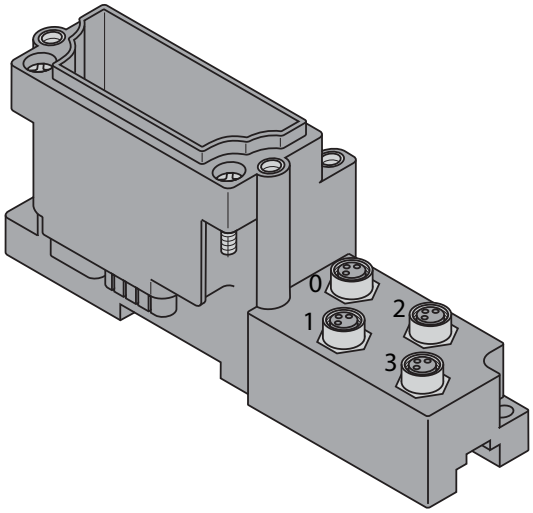


Figure 5-4: Pin assignment BL67-4DI-P with BL67-B-4M8

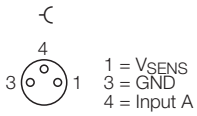
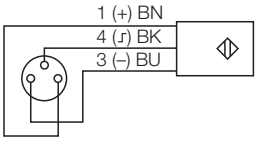


Figure 5-5: Wiring diagram BL67-4DI-P with BL67-B-4M8



- BL67-B-2M12/BL67-B-2M12-P (paired)

Figure 5-6: BL67-B-2M12/ BL67-B-2M12-P

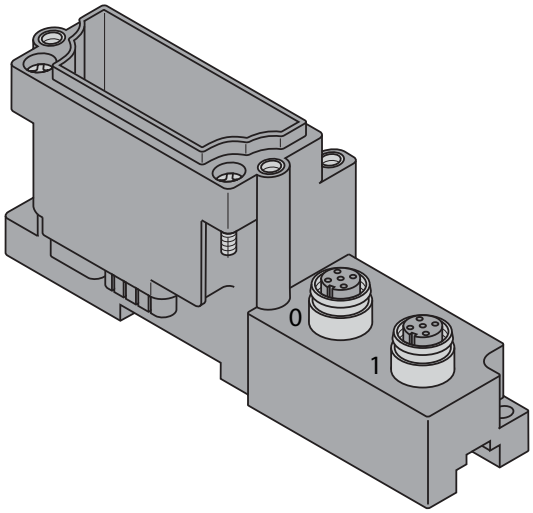


Figure 5-7: Pin assignment BL67-4DI-P with BL67-B-2M12/ BL67-B-2M12-P

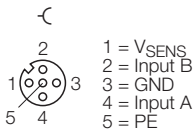
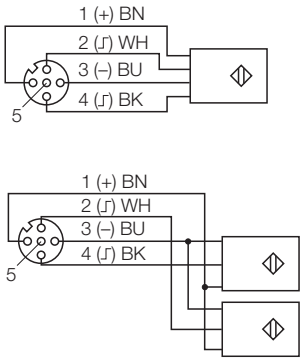


Figure 5-8: Wiring diagram BL67-4DI-P with BL67-B-2M12/ BL67-B-2M12-P



- BL67-B-4M12

Figure 5-9: BL67-B-4M12

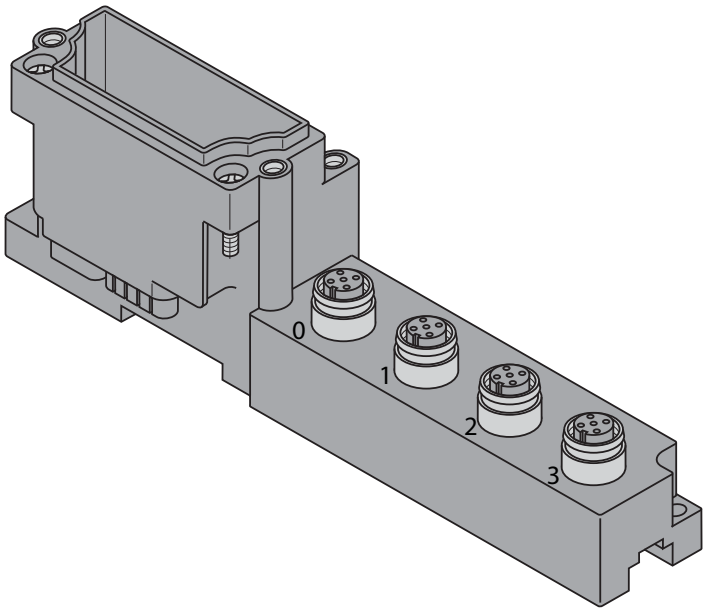


Figure 5-10: Pin assignment BL67-4DI-P with BL67-B-4M12

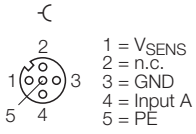


Figure 5-11: Wiring diagram BL67-4DI-P with BL67-B-4M12

- BL67-1M23(-VI)

Figure 5-12:
BL67-1M23(-VI)

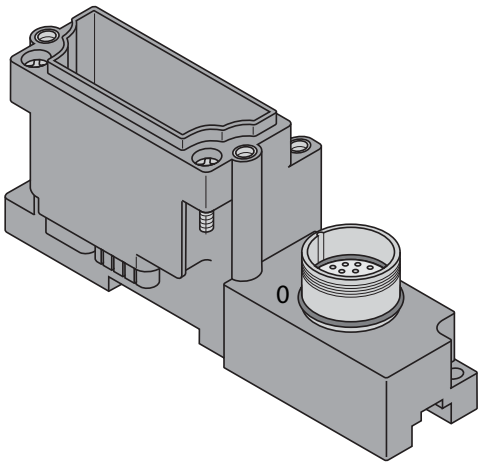
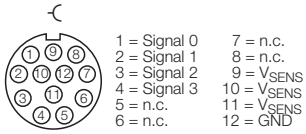


Figure 5-13:
Pin assignment
BL67-4DI-P with
BL67-B-1M23



5.2.6 Signal assignment

Table 5-5: Signal assignment with BL67-B-4M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 5-6: Signal assignment with BL67-B-2M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C1P2	C0P2	C1P4	C0P4

Table 5-7: Signal assignment with BL67-B-2M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C1P2	C1P4	C0P2	C0P4

Table 5-8: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 5-9: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C0P4	C0P3	C0P2	C0P1

n = process data offset in input data; depending on extension of station and the corresponding fieldbus

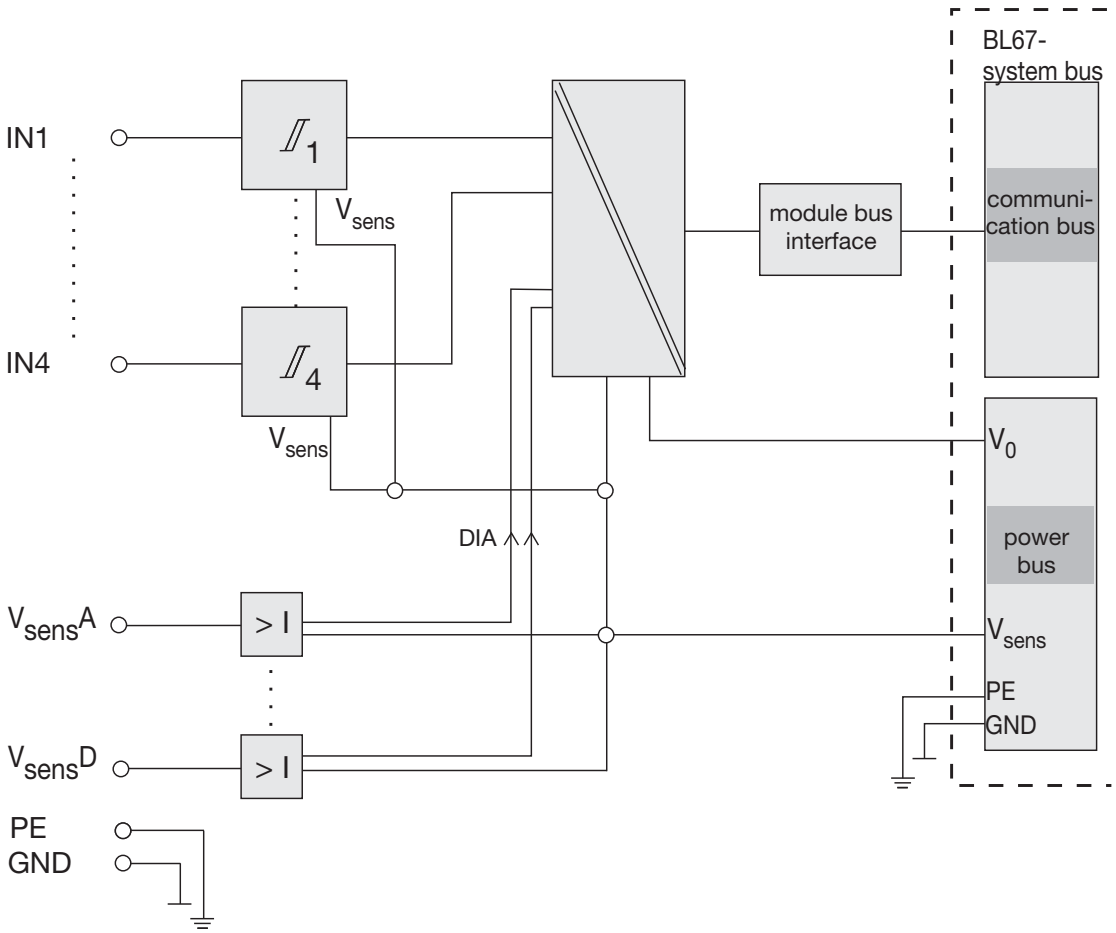
C = slot no.

P = pin no.

5.3 BL67-4DI-PD

Figure 5-14:
BL67-4DI-PD

Figure 5-15:
Block diagram



5.3.1 Technical data

Table 5-10: Technical data

Designation	BL67-4DI-PD
No. of channels	4
Input voltage V_{sens} at nominal value 24 VDC	
Low level	< 4,5 V
High level	> 7 V (max. 30 V)
Nominal current consumption at 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	100 mA (all inputs low)
Power loss of the module	< 1,5 W
Input current I_{in}	
Low level	< 1,5 mA
High level	> 3.7 mA
Input delay	
t_{ON}	< 2,5 ms
t_{OFF}	< 2,5 ms
Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE}	max. 1000 VDC

5.3.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	-	-	-	-	DI3	DI2	DI1	DI0

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 5-11: Process data bits

Process data	value	Meaning
DIx	0	Digital input inactive
	1	Digital input active

5.3.3 Diagnostic and status messages

LED status displays

Table 5-12: LED status displays

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	Red	No field voltage (LED V_I at Power Feeding module is "off")	Check the power supply for the inputs (V_{sens}).
	Red, flashing, 0.5 Hz	Diagnosis pending	-
	OFF	No error messages	–
0 to 3	Green	Status of channel x = "1"	–
	OFF	Status of channel x = "0"	-
	Red flashing, 2 Hz	LED 0 to 3: Overload sensor supply channel x	Check the sensor supply.
	Red	LED 0 and 1: open-circuit monitoring	Check the wires for open-circuits.

Diagnostic data

This module has the following diagnostic data:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	-	-	-	-	Overcurr. sensor supply D	Overcurr. sensor supply C	Overcurr. sensor supply B	Overcurr. sensor supply A
1	-	-	-	-	-	-	Wire break ch 1 and 3	Wire break ch 0 and 1

Table 5-13: Diagnostics

Diagnostics	
Overcurrent sensor supply ch x	Short-circuit or overload at sensor supply A, B, C or D (see Table 5-19)
Wire break ch x	Groupwise wire break detection: Group A (channel 0 and 2) Group B (channel 1 and 3)

5.3.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

Standard				**PROFIBUS PROFINET**		**Parameter**
byte-oriented		**word-oriented**				
Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Activate input filter (channel 0)
	Bit 1		Bit 1		Bit 1	Activate input filter (channel 1)
	Bit 2		Bit 2		Bit 2	Activate input filter (channel 2)
	Bit 3		Bit 3		Bit 3	Activate input filter (channel 3)
	Bit 4		Bit 4		Bit 4	reserved
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Invert digital input (channel 0)
	Bit 1		Bit 9		Bit 1	Invert digital input (channel 1)
	Bit 2		Bit 10		Bit 2	Invert digital input (channel 2)
	Bit 3		Bit 11		Bit 3	Invert digital input (channel 3)
	Bit 4		Bit 12		Bit 4	reserved
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	
Byte 2	Bit 0	Word 1	Bit 0	Byte 2	Bit 0	Activate wire break monitoring (ch. 0 and 2)
	Bit 1		Bit 1		Bit 1	Activate wire break monitoring (ch. 1 and 3)
	Bit 2		Bit 2		Bit 2	reserved
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	reserved
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	

Table 5-14: Module parameters

A *default setting*

Parameter name	Value	Meaning
Activate input filter	0 =no **A**	input filter: 0.25 ms
	1 = yes	input filter: 2.5 ms
Invert digital input	0 =no **A**	Input signal not inverted.
	1 = yes	Input signal inverted, conversion of the effective signal direction for sensors.
Activate wire break monitoring	0 =no **A**	
	1 = yes	Groupwise wire break monitoring

5.3.5 Base modules/pin assignment

- BL67-B-4M8

Figure 5-16: BL67-B-4M8

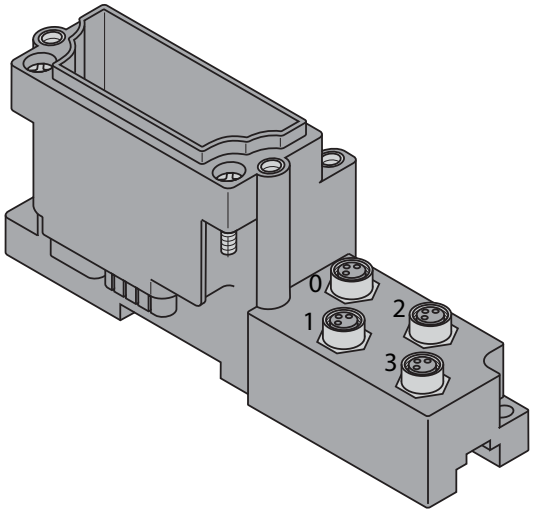


Figure 5-17: Pin assignment BL67-4DI-PD with BL67-B-4M8

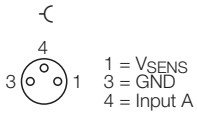
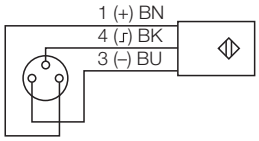


Figure 5-18: Wiring diagram BL67-4DI-PD with BL67-B-4M8



- BL67-B-2M12/BL67-B-2M12-P

Figure 5-19: BL67-B-2M12/ BL67-B-2M12-P

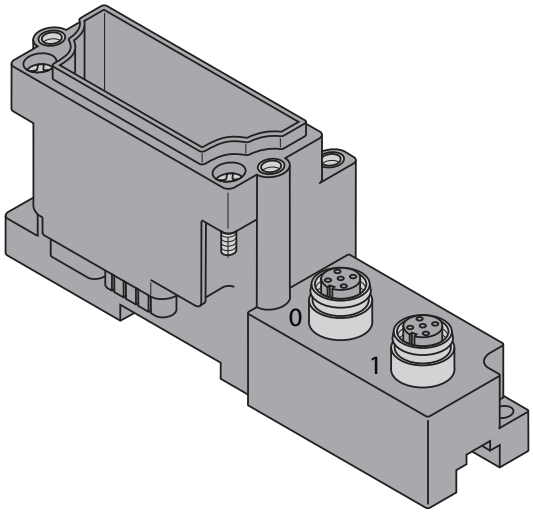


Figure 5-20: Pin assignment BL67-4DI-P with BL67-B-2M12/ BL67-B-2M12-P

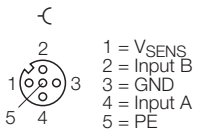


Figure 5-21: Wiring diagram BL67-4DI-PD with BL67-B-2M12/ BL67-B-2M12-P

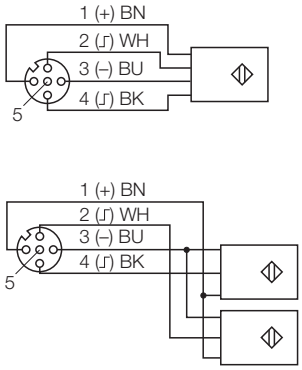
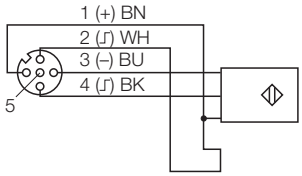


Figure 5-22: Wiring diagram for wire break detection only with base module BL67-B-2M12)

If the wire break detection has been activated, a jumper between pin 1 (24 VDC) and pin 2 (diagnostics input) must be implemented on the sensor side for monitoring of wire-breaks.



- BL67-B-4M12

Figure 5-23: BL67-B-4M12

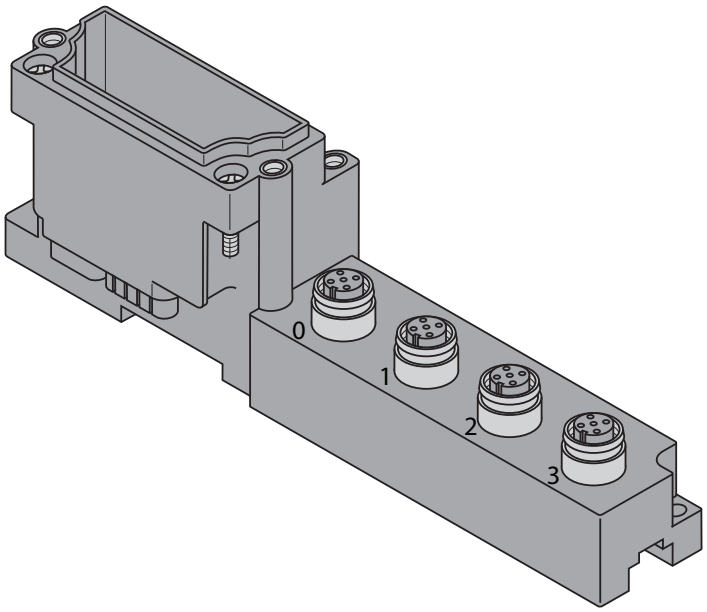


Figure 5-24: Pin assignment BL67-4DI-PD with BL67-B-4M12

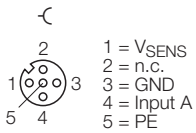
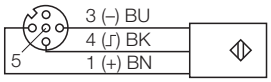


Figure 5-25: Wiring diagram BL67-4DI-PD with BL67-B-4M12



5.3.6 Signal assignment

Table 5-15: Signal assignment with BL67-B-4M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 5-16: Signal assignment with BL67-B-2M12 incl. wire break detection

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C1P2	C0P2	C1P4	C0P4
		-	-	-	-	Wire break 1 + 2		Sensor signal 1 + 2	

Table 5-17: Signal assignment with BL67-B-2M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C1P2	C1P4	C0P2	C0P4

Table 5-18: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C3P4	C2P4	C1P4	C0P4

n = process data offset in input data; depending on extension of station and the corresponding fieldbus

C = slot no.

P = pin no.

5.3.7 sensor supply

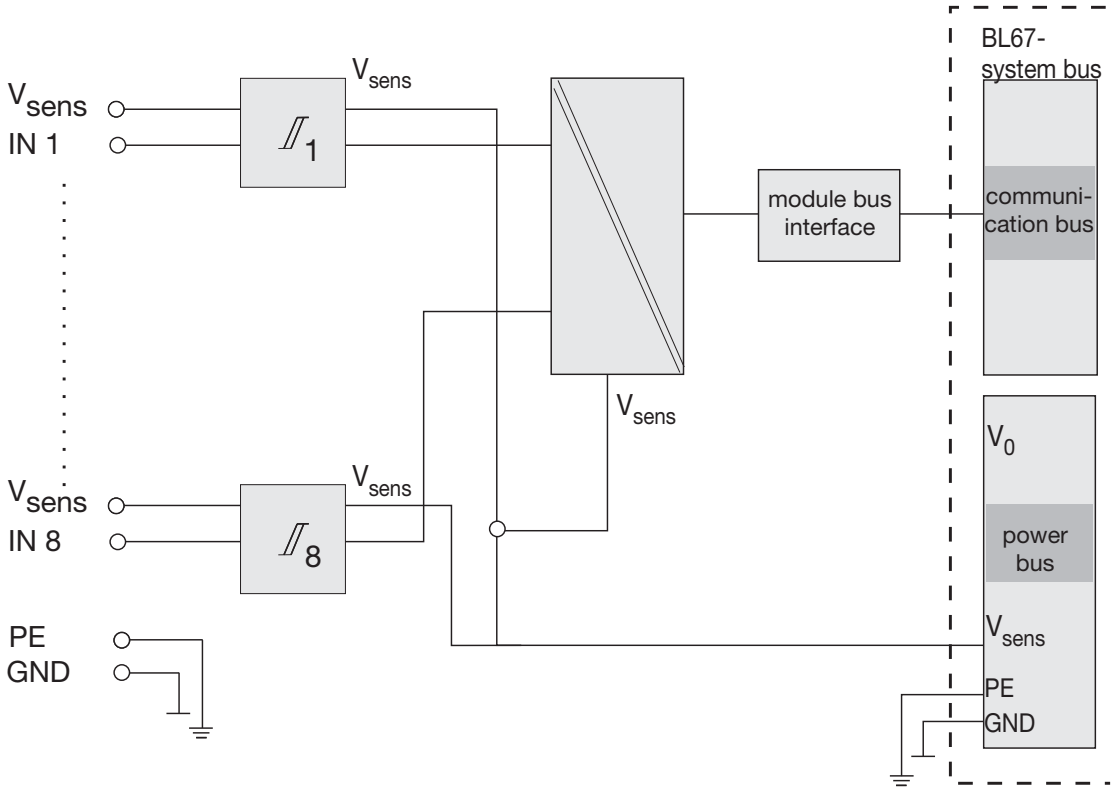
Table 5-19: sensor supply

V_{sens}	A	B	C	D
BL67-B-2M12	C0P1	C1P1	-	-
BL67-B-2M12-P	C0P1	C1P1	-	-
BL67-B-4M12	C0P1	C1P1	C2P1	C3P1
BL67-B-4M8	C0P1	C1P1	C2P1	C3P1

5.4 BL67-8DI-P

Figure 5-26:
BL67-8DI-P

Figure 5-27:
Block diagram



5.4.1 Technical data

Table 5-20: Technical data

Designation	BL67-8DI-P
No. of channels	8
Input voltage V_{sens} at nominal value 24 VDC	
Low level	< 4,5 V
High level	> 7 V (max. 30 V)
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	≤ 40 mA
Power loss of the module	< 250 mW
Input current I_{in}	
Low level	< 0,5 mA
High level	> 3.7 mA
Input delay	
t_{ON}	< 250 µs
t_{OFF}	< 250 µs
Isolation voltage	
U_{TMB} (module bus/field)	max. 1000 VDC

5.4.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 5-21: Process data bits

Process data	Value	Meaning
DIx	0	Digital input inactive
	1	Digital input active

5.4.3 Diagnostic and status messages

LED status displays

Table 5-22: LED status displays

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages	–
0 to 7	Green	Status of channel x = "1"	–
	OFF	Status of channel x = "0"	-

5.4.4 Module parameters

none

5.4.5 Base modules/pin assignment

- BL67-B-8M8

Figure 5-28: BL67-B-8M8

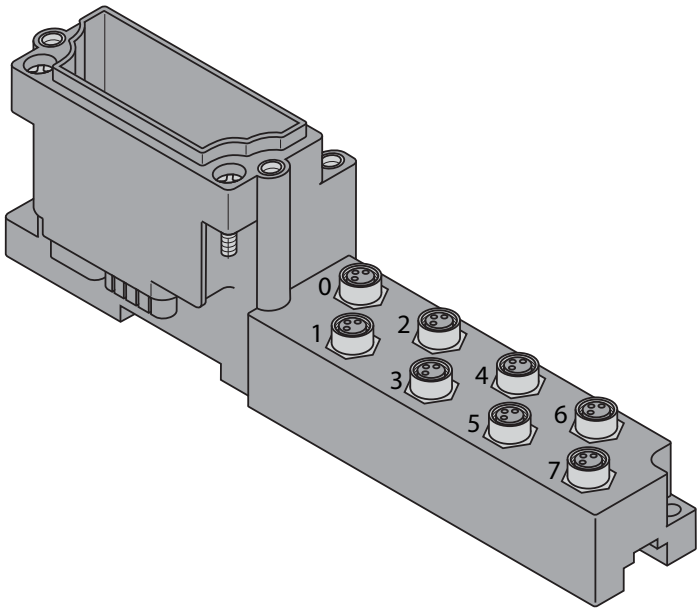


Figure 5-29: Pin assignment BL67-8DI-P with BL67-B-8M8

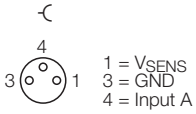
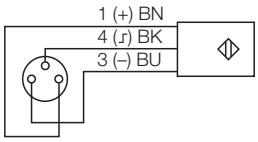


Figure 5-30: Wiring diagram BL67-8DI-P with BL67-B-8M8



- BL67-B-4M12/BL67-B-4M12-P (paired)

Figure 5-31: BL67-B-4M12/ BL67-B-4M12-P

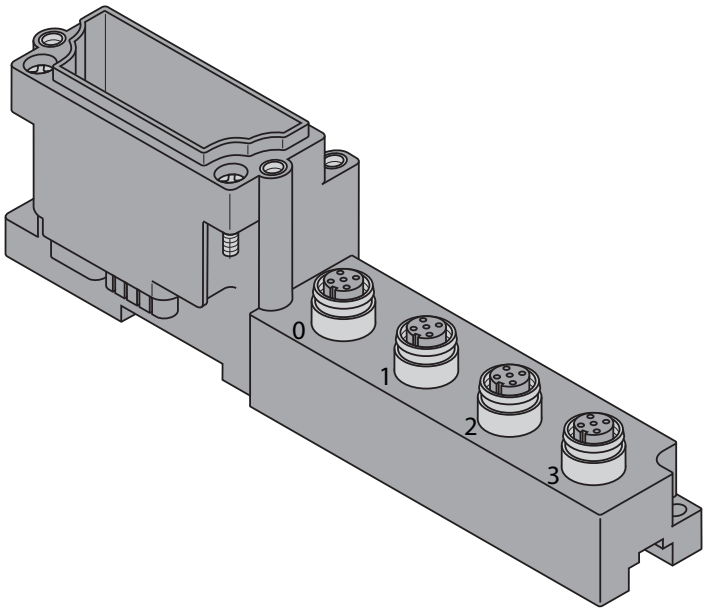


Figure 5-32: Pin assignment BL67-8DI-P with BL67-B-4M12/ BL67-B-4M12-P

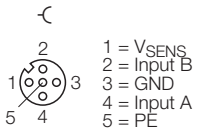
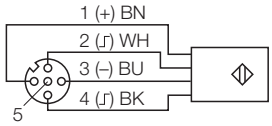
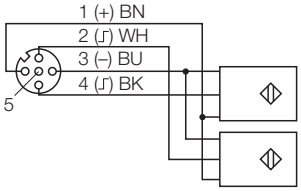


Figure 5-33: Wiring diagram BL67-8DI-P with BL67-B-4M12/ BL67-B-4M12-P





- BL67-1M23

Figure 5-34: BL67-B-1M23

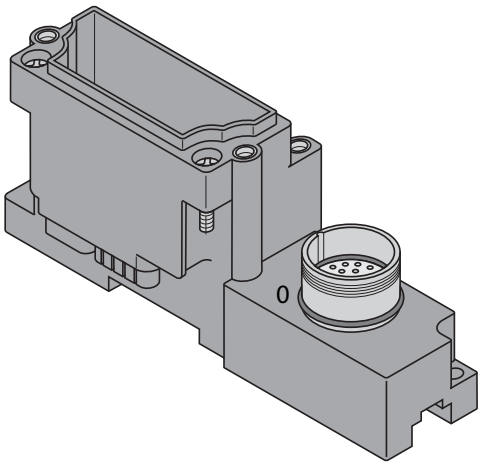
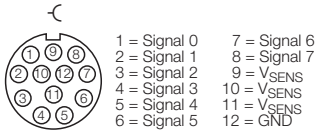


Figure 5-35: Pin assignment BL67-8DI-P with BL67-B-1M23



5.4.6 Signal assignment

Table 5-23: Signal assignment with BL67-B-8M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4

Table 5-24: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C2P2	C1P2	C0P2	C3P4	C2P4	C1P4	C0P4

Table 5-25: Signal assignment with BL67-B-4M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4

Table 5-26: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1

n = process data offset in input data; depending on extension of station and the corresponding fieldbus

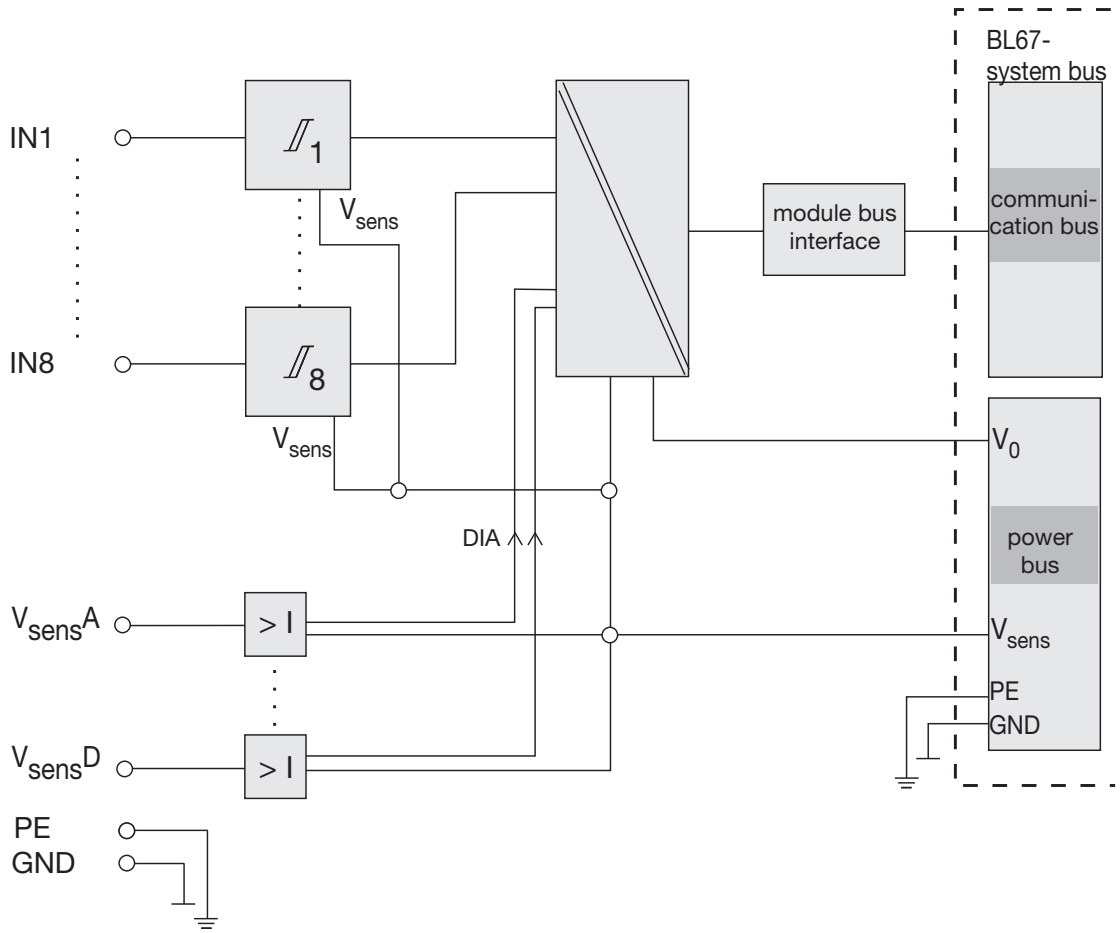
C = slot no.

P = pin no.

5.5 BL67-8DI-PD

Figure 5-36:
BL67-8DI-PD

Figure 5-37:
Block diagram



5.5.1 Technical data

Table 5-27: Technical data

Designation	BL67-8DI-PD
No. of channels	8
Input voltage V_{sens} at nominal value 24 VDC	
Low level	< 4,5 V
High level	> 7 V (max. 30 V)
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	≤ 100 mA (all inputs low)
Power loss of the module	< 1,5 W
Input current I_{in}	
Low level	< 1,5 mA
High level	> 3.7 mA
Input delay	
t_{ON}	< 2,5 ms
t_{OFF}	< 2,5 ms
Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE}	max. 1000 VDC

5.5.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 5-28: Process data bits

Process data	Value	Meaning
DIx	0	Digital input inactive
	1	Digital input active

5.5.3 Diagnostic and status messages

LED status displays

Table 5-29: LED status displays

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	Red	No field voltage (LED V_I at Power Feeding module is "off")	Check the power supply for the inputs (V_{sens}).
	Red, flashing, 0.5 Hz	Diagnosis pending	-
	OFF	No error messages	–
0 to 7	Green	Status of channel x = "1"	–
	OFF	Status of channel x = "0"	-
	Red flashing, 2 Hz	LED 0 to 7: Overload sensor supply channel x	Check the sensor supply.
	Red	LED 0 to 3: open-circuit monitoring	Check the wires for open-circuits.

Diagnostic data

This module has the following diagnostic data available:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	-	-	-	-	Overcurr. sensor supply D	Overcurr. sensor supply C	Overcurr. sensor supply B	Overcurr. sensor supply A
1	-	-	-	-	Wire break ch 3 and 7	Wire break ch 2 and 6	Wire break ch 1 and 5	Wire break ch 0 and 4

Table 5-30: Diagnostics

Diagnostics	
Overcurrent sensor supply	Overcurrent (short circuit) or wire break at the sensor supply A, B, C or D (see Table 5-35)
Wire break	Groupwise wire break detection: Group A (channel 0 and 4) Group B (channel 1 and 5) Group C (channel 2 and 6) Group D (channel 3 and 7)

5.5.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

Standard byte-oriented		Standard word-oriented		PROFIBUS PROFINET		Parameter
Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Activate input filter (channel 0)
	Bit 1		Bit 1		Bit 1	Activate input filter (channel 1)
	Bit 2		Bit 2		Bit 2	Activate input filter (channel 2)
	Bit 3		Bit 3		Bit 3	Activate input filter (channel 3)
	Bit 4		Bit 4		Bit 4	Activate input filter (channel 4)
	Bit 5		Bit 5		Bit 5	Activate input filter (channel 5)
	Bit 6		Bit 6		Bit 6	Activate input filter (channel 6)
	Bit 7		Bit 7		Bit 7	Activate input filter (channel 7)
Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Invert digital input (channel 0)
	Bit 1		Bit 9		Bit 1	Invert digital input (channel 1)
	Bit 2		Bit 10		Bit 2	Invert digital input (channel 2)
	Bit 3		Bit 11		Bit 3	Invert digital input (channel 3)
	Bit 4		Bit 12		Bit 4	Invert digital input (channel 4)
	Bit 5		Bit 13		Bit 5	Invert digital input (channel 5)
	Bit 6		Bit 14		Bit 6	Invert digital input (channel 6)
	Bit 7		Bit 15		Bit 7	Invert digital input (channel 7)
Byte 2	Bit 0	Word 1	Bit 0	Byte 2	Bit 0	Activate wire break monitoring (ch. 0 and 4)
	Bit 1		Bit 1		Bit 1	Activate wire break monitoring (ch. 1 and 5)
	Bit 2		Bit 2		Bit 2	Activate wire break monitoring (ch. 2 and 6)
	Bit 3		Bit 3		Bit 3	Activate wire break monitoring (ch. 3 and 7)
	Bit 4		Bit 4		Bit 4	reserved
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	reserved
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	

Table 5-31: Module parameters

A *default setting*

Parameter name	Value	Meaning
Activate input filter	0 =no **A**	input filter: 0.25 ms
	1 = yes	input filter: 2.5 ms
Invert digital input	0 =no **A**	Input signal not inverted.
	1 = yes	Input signal inverted. conversion of the effective signal direction for sensors
Activate wire break monitoring	0 =no **A**	
	1 = yes	Groupwise wire break monitoring

5.5.5 Base modules/pin assignment

- BL67-B-8M8

Figure 5-38: BL67-B-8M8

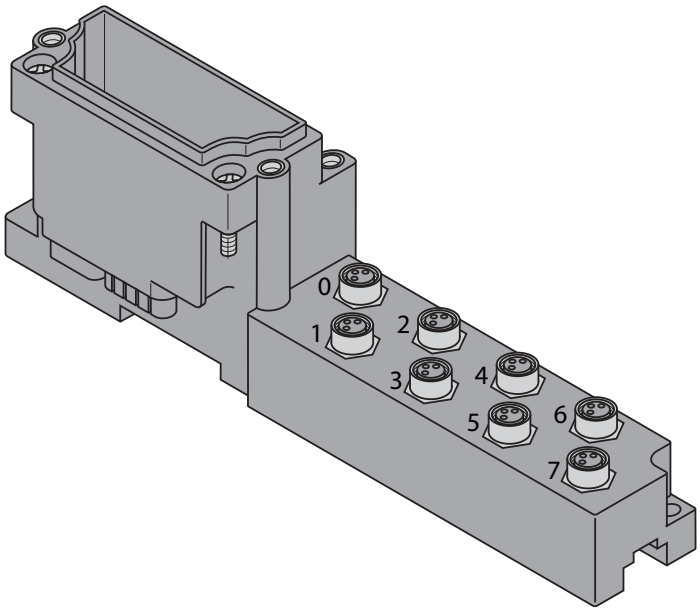


Figure 5-39: Pin assignment BL67-8DI-PD with BL67-B-8M8

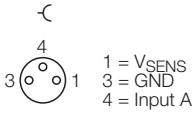
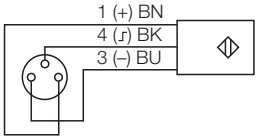


Figure 5-40: Wiring diagram BL67-8DI-PD with BL67-B-8M8



- BL67-B-4M12/BL67-B-4M12-P (paired)

Figure 5-41: BL67-B-4M12/ BL67-B-4M12-P

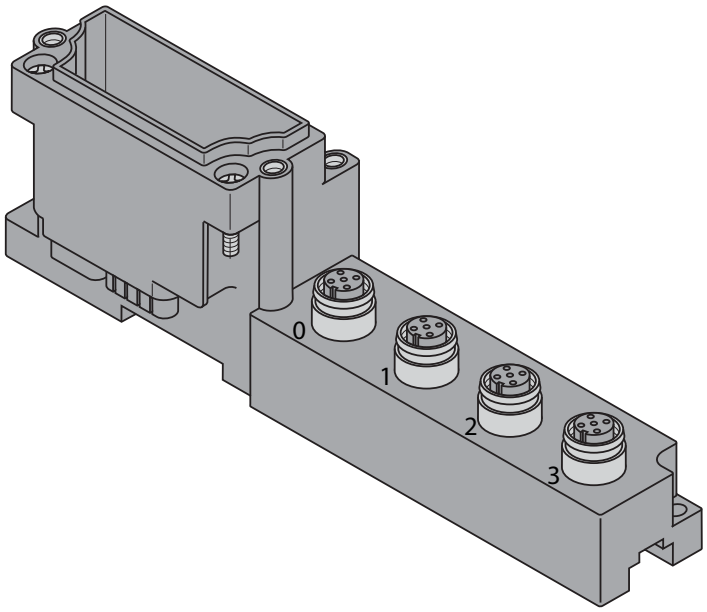


Figure 5-42: Pin assignment BL67-8DI-PD with BL67-B-4M12/ BL67-B-4M12-P

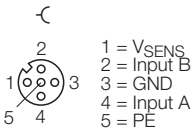


Figure 5-43: Wiring diagram BL67-8DI-PD with BL67-B-4M12/ BL67-B-4M12-P

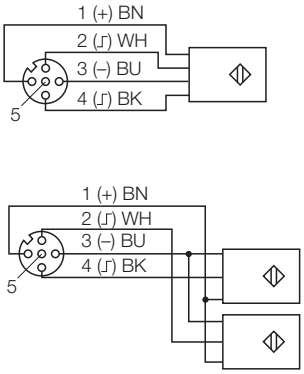
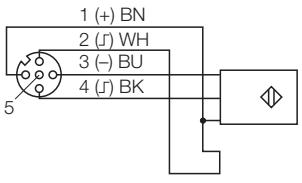


Figure 5-44: Wiring diagram for wire break detection only with base module BL67-B-4M12

If the wire break detection has been activated, a jumper between pin 1 (24 VDC) and pin 2 (diagnostics input) must be implemented on the sensor side for monitoring of wire-breaks.



5.5.6 Signal assignment

Table 5-32: Signal assignment with BL67-B-8M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4

Table 5-33: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C2P2	C1P2	C0P2	C3P4	C2P4	C1P4	C0P4
		Wire break sensor 1 to 4				Sensor signal 1 to 4			

Table 5-34: Signal assignment with BL67-B-4M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4

n = offset of input data; depending on extension of station and the corresponding fieldbus.

C = slot no.

P = pin no.

5.5.7 Sensor supply

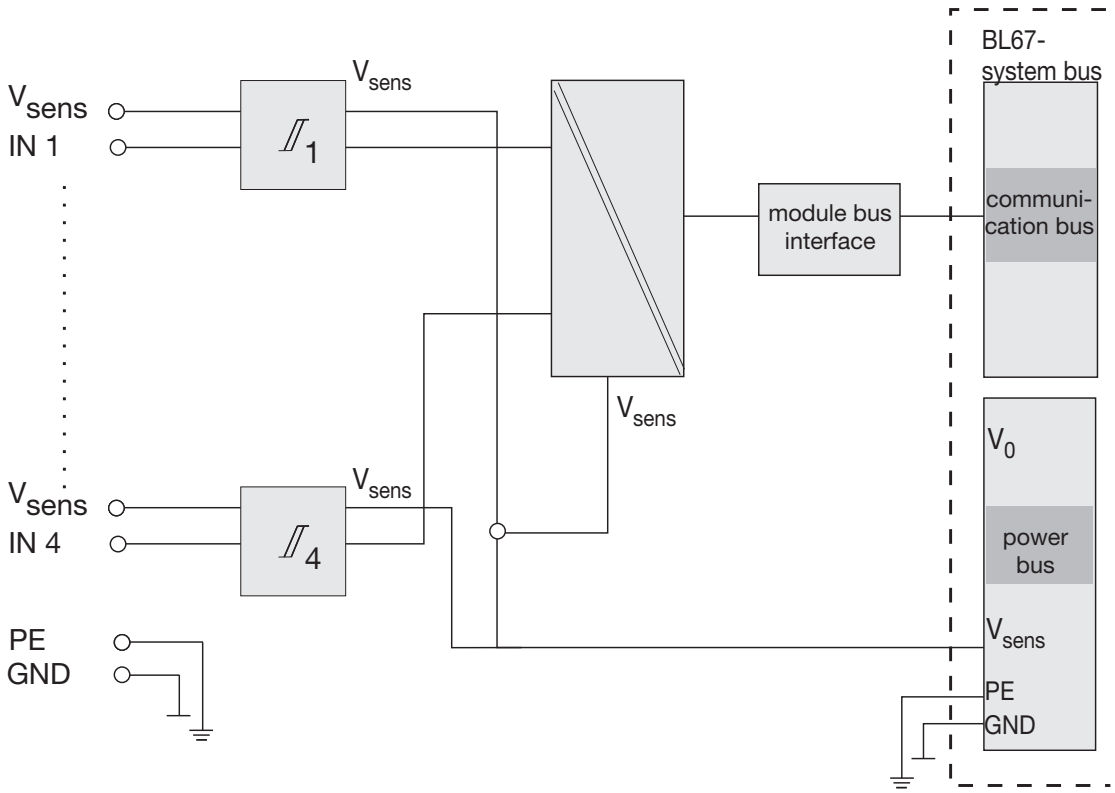
Table 5-35: Sensor supply

V_{sens}	A	B	C	D
BL67-B-4M12	C0P1	C1P1	C2P1	C3P1
BL67-B-4M12-P	C0P1	C1P1	C2P1	C3P1
BL67-B-8M8	C0P1/ C1P1	C2P1/ C3P1	C4P1/ C5P1	C6P1/ C7P1

5.6 BL67-4DI-N

Figure 5-45:
BL67-4DI-N

Figure 5-46:
Block diagram



5.6.1 Technical data

Table 5-36: Technical data

Designation	BL67-4DI-N
No. of channels	4
Input voltage V_{sens} at nominal value 24 VDC	
Low level	> 7 V (max. 30 V)
High level	< 5 V
Nominal current consumption at 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	≤ 1 mA (all inputs low)
Power loss of the module	< 1,3 W
Input current I_{in}	
Low level	< 2,5 mA
High level	> 3 mA
Input delay	
t_{ON}	< 250 µs
t_{OFF}	< 250 µs
Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE}	max. 1000 VDC

5.6.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	-	-	-	-	DI3	DI2	DI1	DI0

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 5-37: Process data bits

Process data	Value	Meaning
DIx	0	Digital input inactive
	1	Digital input active

5.6.3 Diagnostic and status messages

LED status displays

Table 5-38: LED status displays

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages	–
0 to 3	Green	Status of channel x = "1"	–
	OFF	Status of channel x = "0"	-

5.6.4 Module parameters

none

5.6.5 Base modules/pin assignment

- BL67-B-4M8

Figure 5-47: BL67-B-4M8

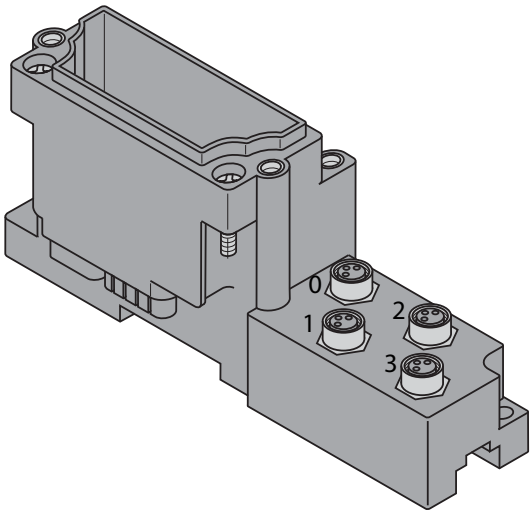


Figure 5-48: Pin assignment BL67-4DI-N with BL67-B-4M8

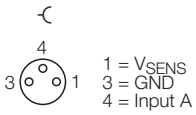
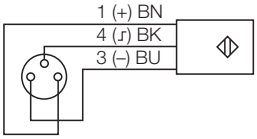


Figure 5-49: Wiring diagram BL67-4DI-N with BL67-B-4M8



- BL67-B-2M12/BL67-B-2M12-P (paired)

Figure 5-50: BL67-B-2M12/ BL67-B-2M12-P

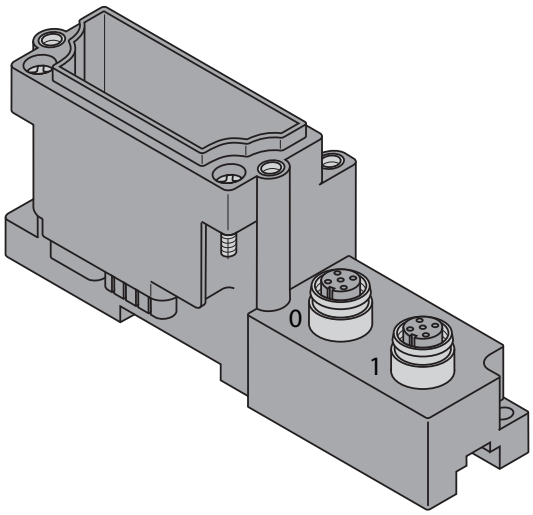


Figure 5-51: Pin assignment BL67-4DI-N with BL67-B-2M12/ BL67-B-2M12-P

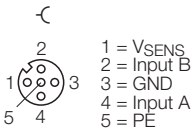
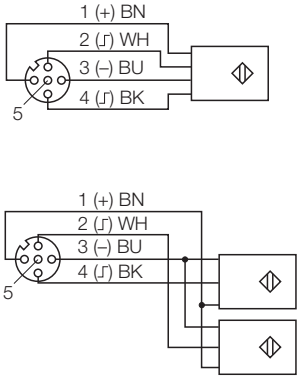


Figure 5-52: Wiring diagram BL67-4DI-N with BL67-B-2M12/ BL67-B-2M12-P



- BL67-B-4M12

Figure 5-53:
BL67-B-4M12

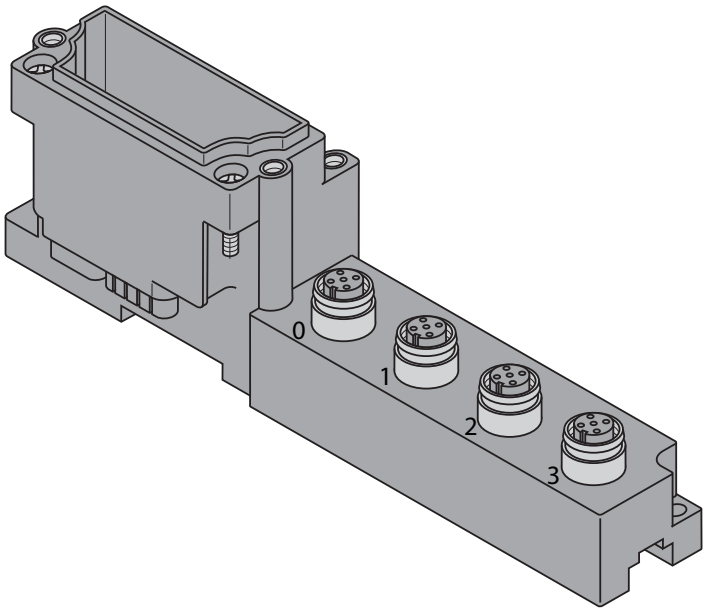


Figure 5-54:
Pin assignment
BL67-4DI-N with
BL67-B-4M12

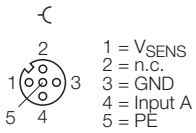
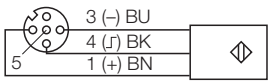


Figure 5-55:
Wiring diagram
BL67-4DI-N with
BL67-B-4M12



- BL67-1M23

Figure 5-56:
BL67-B-1M23

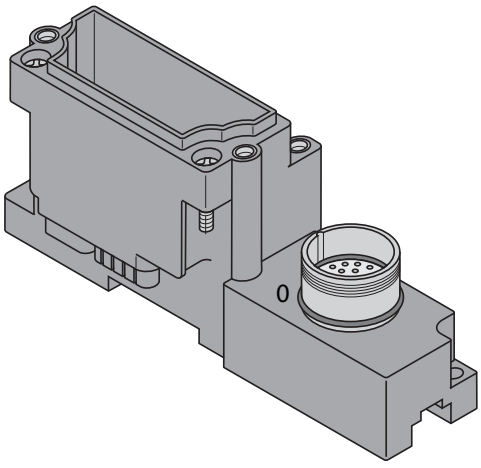
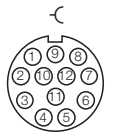


Figure 5-57: Pin assignment BL67-4DI-N with BL67-B-1M23



5.6.6 Signal assignment

Table 5-39: Signal assignment with BL67-B-4M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 5-40: Signal assignment with BL67-B-2M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C1P2	C0P2	C1P4	C0P4

Table 5-41: Signal assignment with BL67-B-2M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C1P2	C1P4	C0P2	C0P4

Table 5-42: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 5-43: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C0P4	C0P3	C0P2	C0P1

n = offset of input data; depending on extension of station and the corresponding fieldbus.

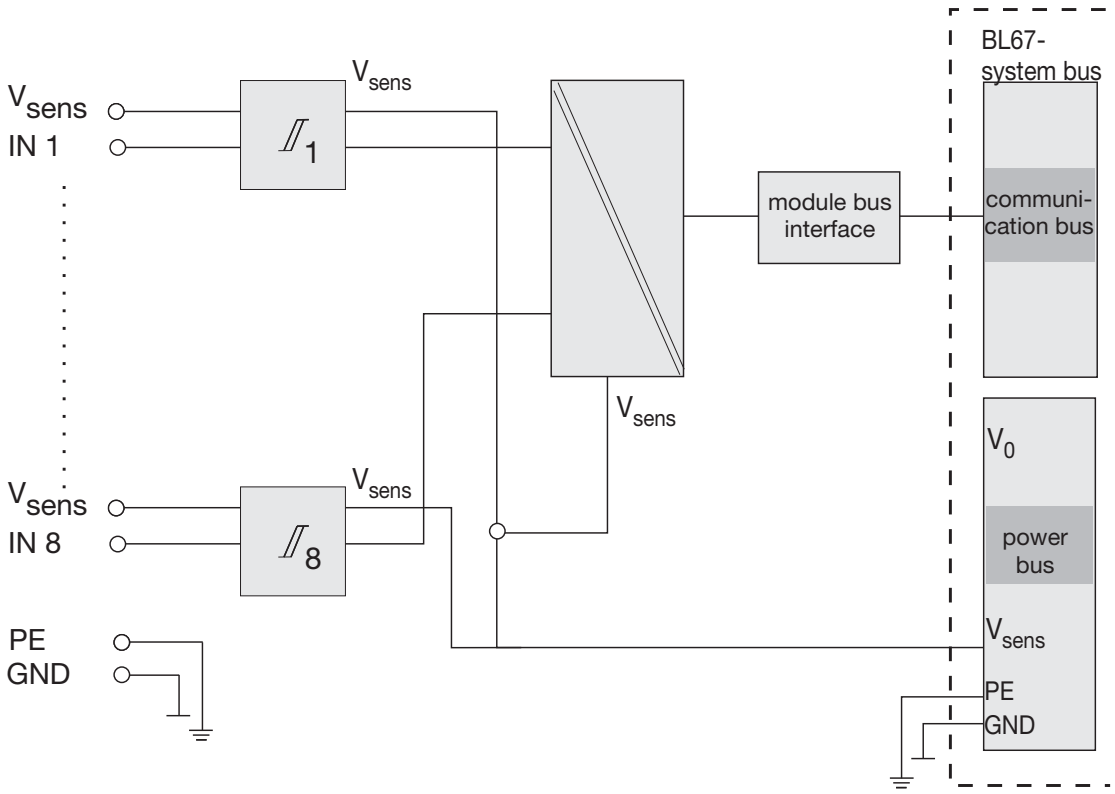
C = slot no.

P = pin no.

5.7 BL67-8DI-N

Figure 5-58:
BL67-8DI-N

Figure 5-59:
Block diagram



5.7.1 Technical data

Table 5-44: Technical data

Designation	BL67-8DI-N
No. of channels	8
Input voltage V_{sens} at nominal value 24 VDC	
Low level	> 7 V (max. 30 V)
High level	< 5 V
Nominal current consumption at 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	≤ 1 mA (all inputs low)
Power loss of the module	< 1,3 W
Input current I_{in}	
Low level	< 1,2 mA
High level	> 1.5 mA
Input delay	
t_{ON}	< 250 µs
t_{OFF}	< 250 µs
Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE}	max. 1000 VDC

5.7.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 5-45: Process data bits

Process data	Value	Meaning
DIx	0	Digital input inactive
	1	Digital input active

5.7.3 Diagnostic and status messages

LED status displays

Table 5-46: LED status displays

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	Red, flashing, 0.5 Hz	Diagnosis pending	-
	OFF	No error messages	–
0 to 7	Green	Status of channel x = "1"	–
	OFF	Status of channel x = "0"	-

5.7.4 Module parameters

none

5.7.5 Base modules/pin assignment

- BL67-B-8M8

Figure 5-60: BL67-B-8M8

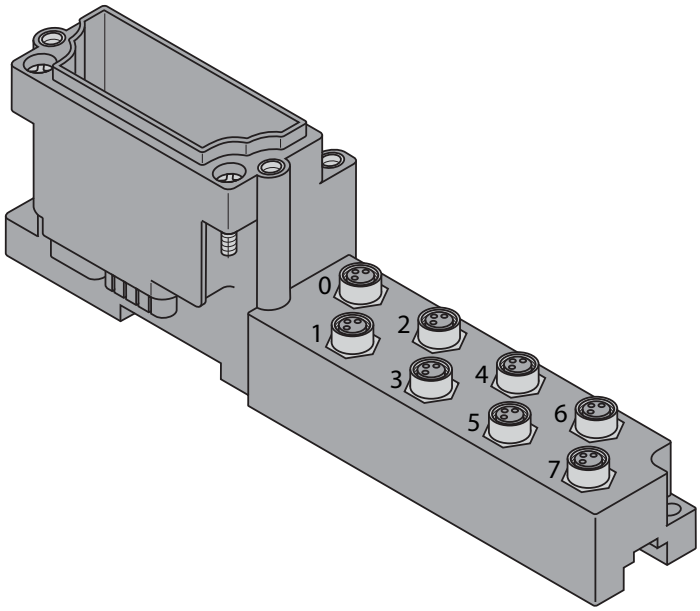


Figure 5-61: Pin assignment BL67-8DI-N with BL67-B-8M8

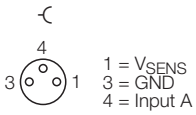
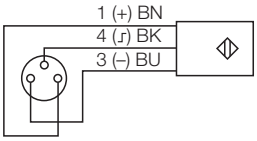


Figure 5-62: Wiring diagram BL67-8DI-N with BL67-B-8M8



- BL67-B-4M12/BL67-B-4M12-P (paired)

Figure 5-63:
BL67-B-4M12/
BL67-B-4M12-P

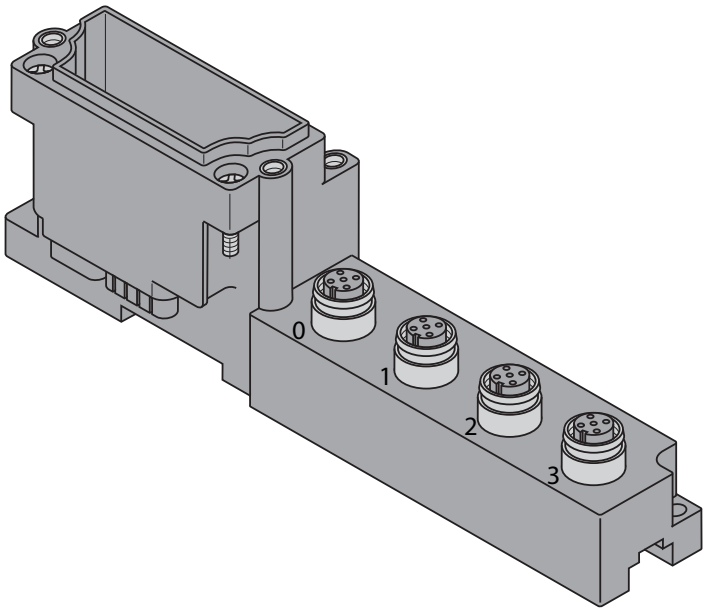


Figure 5-64:
Pin assignment
BL67-8DI-N with
BL67-B-4M12/
BL67-B-4M12-P

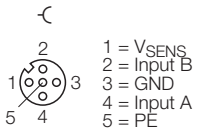
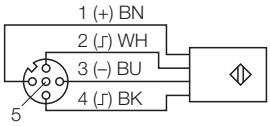
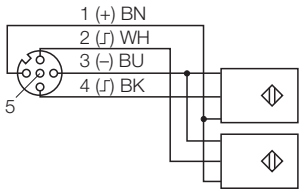


Figure 5-65:
Wiring diagram
BL67-8DI-N with
BL67-B-4M12/
BL67-B-4M12-P





- BL67-1M23

Figure 5-66: BL67-B-1M23

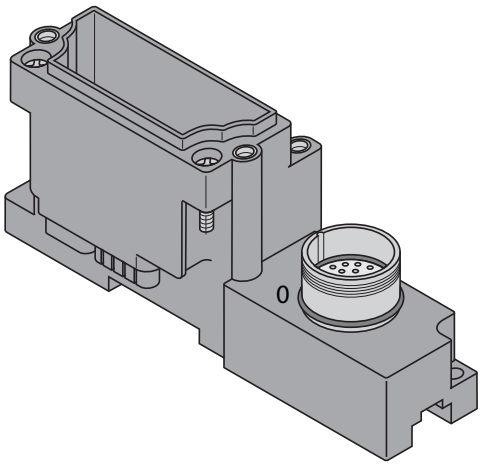
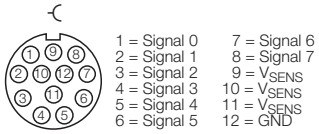


Figure 5-67: Pin assignment BL67-8DI-N with BL67-B-1M23



5.7.6 Signal assignment

Table 5-47: Signal assignment with BL67-B-8M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4

Table 5-48: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C2P2	C1P2	C0P2	C3P4	C2P4	C1P4	C0P4

Table 5-49: Signal assignment with BL67-B-4M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4

Table 5-50: Signal assignment with BL67-1M23(-VI)

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1

n = offset of input data; depending on extension of station and the corresponding fieldbus.

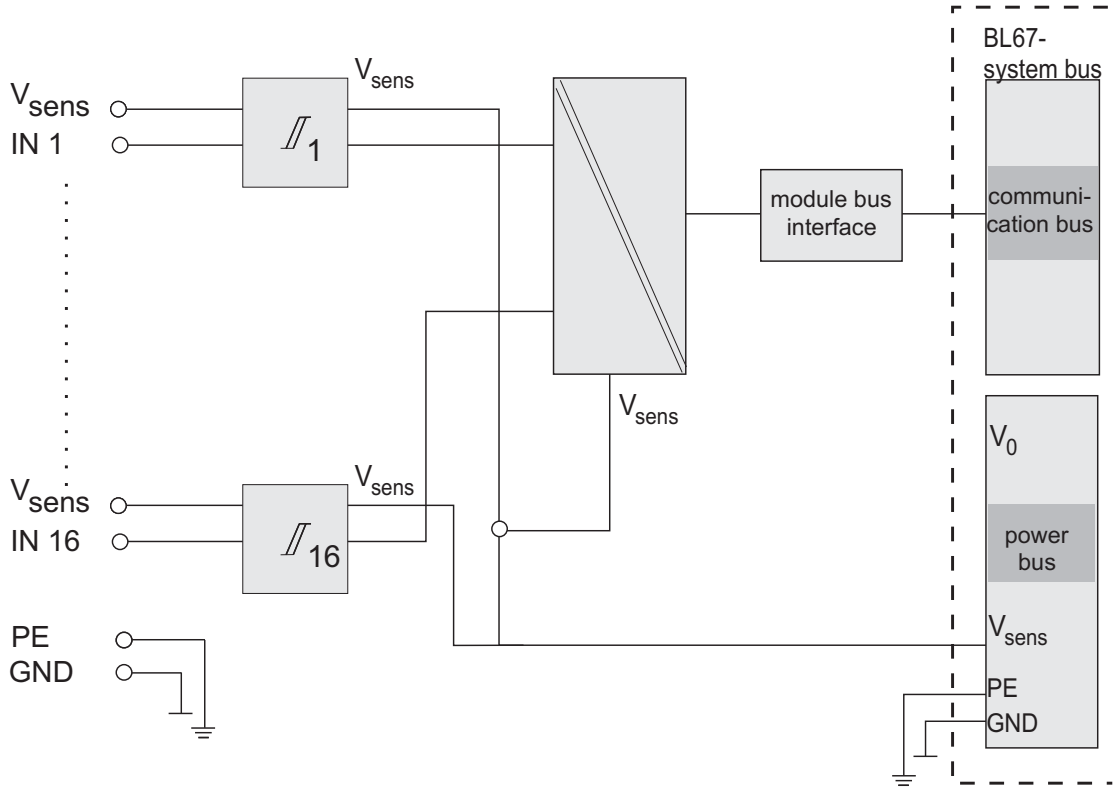
C = slot no.

P = pin no.

5.8 BL67-16DI-P

Figure 5-68:
BL67-16DI-P

Figure 5-69:
Block diagram



5.8.1 Technical data

Table 5-51: Technical data

Designation	BL67-16DI-P
No. of channels	16
Input voltage V_{sens} at nominal value 24 VDC	
Low level	< 4,5 V
High level	> 7 V (max. 30 V)
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	≤ 3 mA (all inputs low)
max sensor supply I_{sens}	4 A via gateway or Power Feeding module, electronically short circuit limited
Power loss of the module	< 100 mW
Input current I_{in}	
Low level	< 1,5 mA
High level	2,1 to 3,7 mA
Input delay	0.3 ms
Isolation voltage	
U (electronic/field)	500 VDC

5.8.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0
	n + 1	DI15	DI14	DI13	DI12	DI11	DI10	DI9	DI8

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 5-52: Process data bits

Process data	Value	Meaning
DIx	0	Digital input inactive
	1	Digital input active

5.8.3 Diagnostic and status messages

LED status displays

Table 5-53: LED status displays

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages	–
0 to 7	Green	status of channel 0 to 7 = 1	–
	orange	status of channel 8 to 15 = 1	
	OFF	status of channel x = "0"	-

5.8.4 Module parameters

none

5.8.5 Base modules/pin assignment

- BL67-B-8M8-4-P

Figure 5-70: BL67-B-8M8-4-P

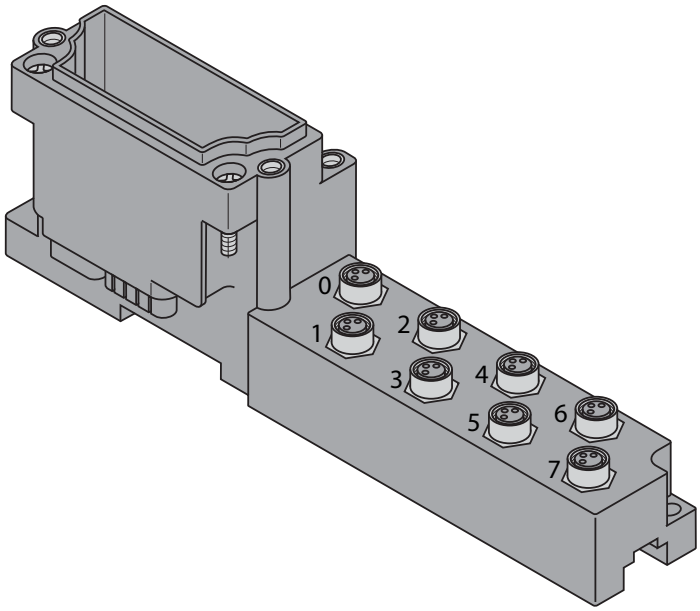
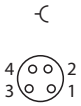


Figure 5-71: Pin assignment BL67-16DI-P with BL67-B-8M8-4-P



1 = V_{SENS}
2 = Signal A
3 = GND
4 = Signal B

- BL67-1M23-19

Figure 5-72: BL67-B-1M23-19

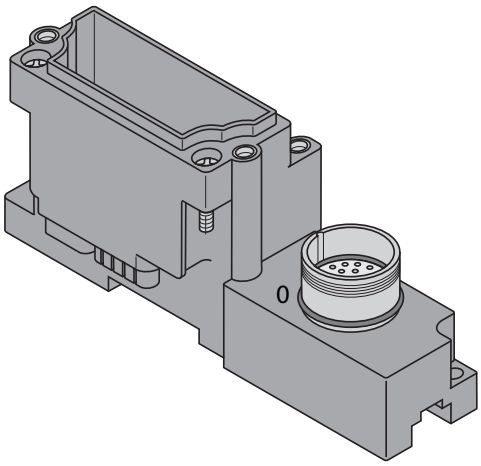
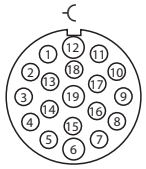


Figure 5-73: Pin assignment BL67-16DI-P with BL67-B-1M23-19



1 = Input 14
2 = Input 10
3 = Input 6
4 = Input 3
5 = Input 2
6 = GND
7 = Input 1
8 = Input 5
9 = Input 9
10 = Input 13
11 = Input 12
12 = PE
13 = Input 11
14 = Input 7
15 = Input 0
16 = Input 4
17 = Input 8
18 = Input 15
19 = V_{SENS}

Accessory:
field-wireable connector (for example):
FW-M23ST19Q-G-LT-ME-XX-10

5.8.6 Signal assignment

Table 5-54: Signal assignment with BL67-B-8M8-4-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4
	Byte	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
	n	C7P2	C7P4	C6P2	C6P4	C5P2	C5P4	C4P2	C4P4

Table 5-55: Signal assignment with BL67-B-1M23-19

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C0P14	C0P3	C0P8	C0P16	C0P4	C0P5	C0P7	C0P15
	Byte	**Bit 15**	**Bit 14**	**Bit 13**	**Bit 12**	**Bit 11**	**Bit 10**	**Bit 9**	**Bit 8**
	n	C0P18	C0P1	C0P10	C0P11	C0P13	C0P2	C0P9	C0P17

n = process data offset in input data; depending on extension of station and the corresponding fieldbus

C = slot no.

P = pin no.

6 Analog input modules

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6.1 Overview

Analog input modules (AI) detect standard electrical signals at the connections of the base modules, digitalize them and transmit the corresponding measurement values to the gateway via the internal module bus.

The sensor supply (V_{sens}) is tapped from the internal voltage supply bus.
This voltage is supplied by the gateway or a Power Feeding module.

Both contain a short circuit detection for the sensor supply voltage.

The module bus electronics of the analog input modules are galvanically isolated from the field level via an opto-coupler. The module provides reverse polarity protection.

Supported signal ranges

- BL67-2AI-I:
  0 to 20 mA
  4 to 20 mA
- BL67-2AI-V:
  0 to 10 VDC
  -10 to 10 VDC

Connectable sensors

- BL67-2AI-PT
  platinum sensors Pt100, Pt200, Pt500, Pt1000
  nickel sensors (Ni100, Ni1000)
- BL67-2AI-TC
  thermo elements (Types: B, E, J, K, N, R, S, T)

LED displays

Error signals from the I/O level are indicated by each module via the "D" LED. The corresponding diagnostic information is transmitted to the gateway via diagnostic bits.

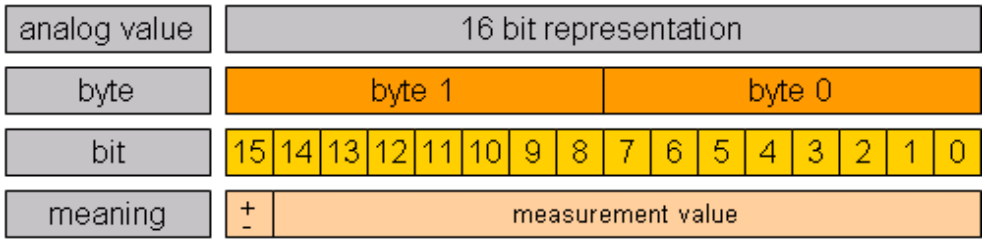
6.1.1 Analog data representation

The analog values can either be represented with 16 or 12 bit. The two's-complement representation allow the representation of positive as well as negative values. The bits marked with an "X" are not relevant for the analog value representation.

16-bit-representation:

The 16-bit-representation is realized as a **two's-complement**: 2 byte of process data are completely occupied:

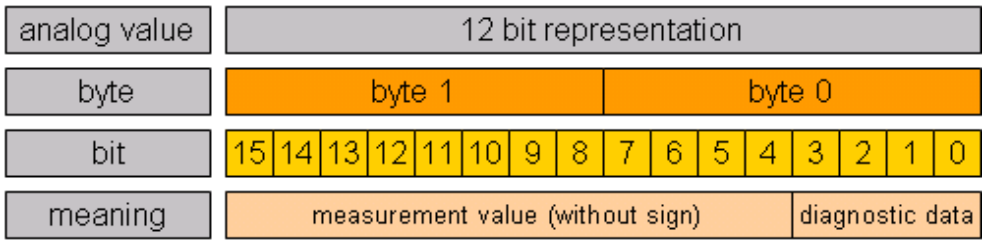
Figure 6-1: 16-bit-representation



12-bit-representation (left-justified):

In the voltage measurement/output and in the temperature measurement, the value is represented as a two's-complement. In the current measurement/output and in the resistance measurement, the value is represented as a binary **number**. The 12 bit value is **left-justified** and occupies bit 15 to 4 of the process data:

Figure 6-2: 12-bit-representation



The diagnostic data is integrated in the process input data and occupies 4 bit (right-justified).

NOTE

A detailed description of the measurement value representation for the analog input modules in 16 or 12 bit can be found in the Appendix of this manual, Analog value representation (analog input modules) (page 15-8).

The figure shows a 5-digit binary code in the outer circuit. The inner circuit shows the respective dual number, if the binary code is interpreted as binary number (positive numerical values) and as two's complement.

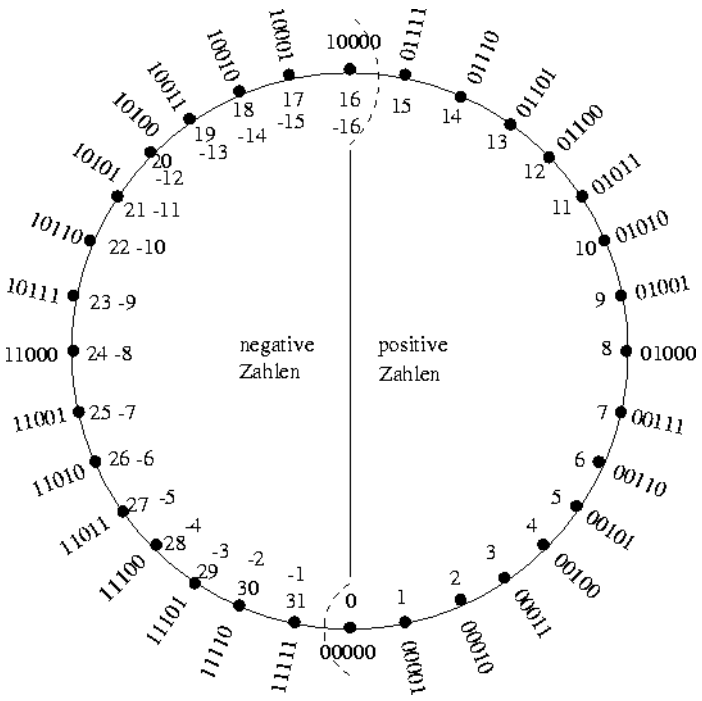


Figure 6-3: Binary code as dual number ans two's complement

6.1.2 Module overview

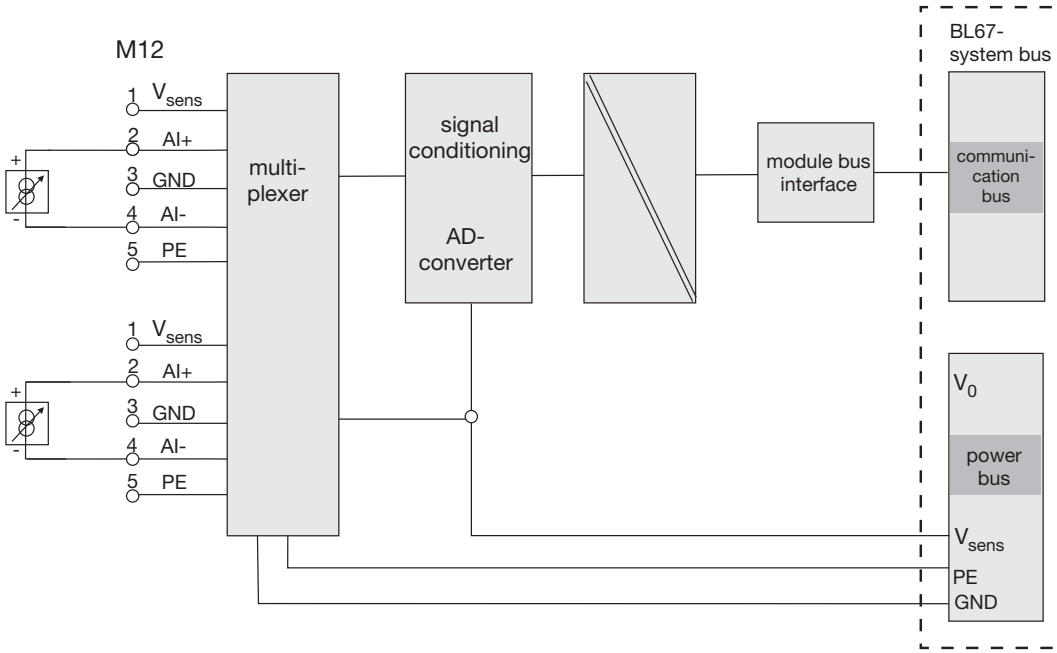
Table 6-1: Module overview

Module	No. of channels
BL67-2AI-I	2
BL67-2AI-V	2
BL67-2AI-PT	2
BL67-2AI-TC	2
BL67-4AI-V/I	4
BL67-4AI-TC	4

6.2 BL67-2AI-I, 0/4 ... 20mA

Figure 6-4:
BL67-2AI-I

Figure 6-5:
Block diagram



6.2.1 Technical data

Table 6-2: Technical data

Designation	BL67-2AI-I
No. of channels	2
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 35 mA
Nominal current from supply terminal (field) I_L	≤ 12 mA
Power loss of the module, typical P_{MAX}	< 1 W
Input current	0/4 to 20 mA
Max. input current	50 mA
Isolation voltage	
U_{TMB} (module bus/field)	min. 500 V_{eff}
U_{Fe} (field/functional earth)	min. 50 V_{AC}
channel/channel	none
channel/field supply	none
channel/system supply	500 V_{eff}
Input resistance (burden)	< 125 Ω
Cutoff frequency (-3 dB)	≥ 50 Hz
Basic error at 23 °C/73.4 °F	± 0,2 %
Repeat accuracy	0,05 %
Temperature coefficient	≤ 300 ppm/°C
Resolution of the A/D converter	16 bit
Measuring principle	Delta Sigma
Measurement value representation	– 16 Bit: two's complement coded or – 12 bit left-justified two's complement coded (even negative values possible), binary number without coding (only positive values possible)
I_{SENS} (sensor supply from V_{sens})	≤ 250 mA; short-circuit protected in gateway or Power Feeding module

6.2.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	AI0 LSB							
	n + 1	AI0 MSB							
	n + 2	AI1 LSB							
	n + 3	AI1 MSB							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 6-3: Process data bits

Process data	Meaning
AI1 LSB	low byte of the analog value
AIx MSB	high byte of the analog value

6.2.3 Diagnostic and status messages

LED status displays

Table 6-4: LED status displays

LED	Display	Meaning	Remedy
D	red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–

Diagnostic data

This module has the following diagnostic data **per channel**:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	-	Wire break	Measured value out of range

Table 6-5: Diagnostics

Diagnostics	Meaning
Measured value out of range	Indicates an over- or undercurrent of 1 % of the set current range; whereby, undercurrents can only be recognized with those modules that have a set current range of 4 to 20 mA.
– Overcurrent I_{max} (I > 20,2 mA)	
– Undercurrent: I_{min} (I < 3,8 mA)	
Wire break (I < 3 mA)	Displays a wire break in the signal line for the operating mode 4 to 20 mA.

NOTE

In the 12-bit-representation (left-justified) the diagnostic data are transmitted with the lower nibble of the process data for the respective channel.

6.2.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard byte-oriented		Standard word-oriented		PROFIBUS PROFINET		Parameter
Channel 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Measurement range
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	Deactivate diagnostics
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	reserved
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
Channel 1	Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Measurement range
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	Deactivate diagnostics
		Bit 3		Bit 11		Bit 3	Deactivate channel
		Bit 4		Bit 12		Bit 4	reserved
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

Table 6-6: Module parameters

A *default setting*

Parameter name	Value
Measurement range	0 = 0 … 20 mA **A**
	1 = 4 … 20 mA
Data format	0 = 15 bit + sign **A**
	1 = 12 bit (left-justified)
Deactivate diagnostics	0 =no **A**
	1 = yes
Deactivate channel	0 =no **A**
	1 = yes

6.2.5 Base modules/pin assignment

- BL67-B-2M12

Figure 6-6:
BL67-B-2M12

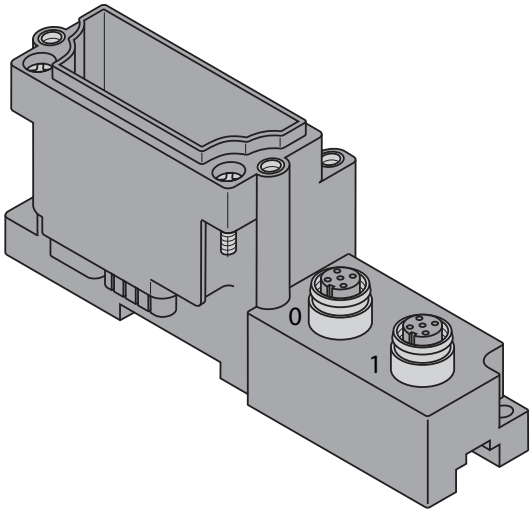


Figure 6-7:
Pin assignment BL67-2AI-I

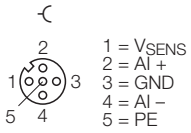
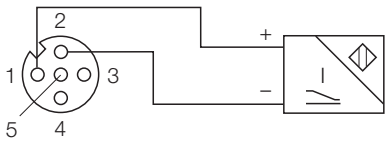
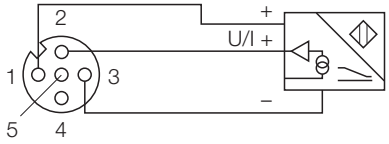


Figure 6-8: Wiring diagrams BL67-2AI-I

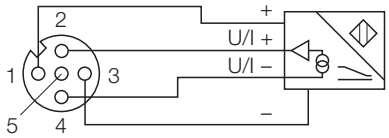
2-wire sensor with sensor supply via base module:



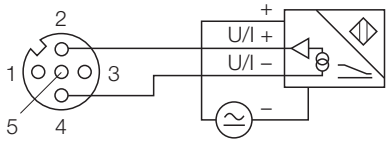
3-wire sensor with sensor supply via base module:



4-wire sensor with sensor supply via base module:



4-wire sensor with external sensor supply:



6.2.6 Measurement value representation

16-bit-representation

- Current values from 0 to 20 mA

  The value range:
  0 mA to 20 mA
  is displayed as follows:
  0000_{hex} bis $7FFF_{hex}$ (decimal: **0 to 32767)**

- Current values from 4 to 20 mA

  The value range:
  4 mA to 20 mA
  is displayed as follows:
  0000_{hex} bis $7FFF_{hex}$ (decimal: **0 to 32767)**

12-bit-representation (left-justified)

- Current values from 0 to 20 mA

  The value range:
  0 mA to 20 mA
  is displayed as follows:
  $000(0)_{hex}$ to $FFF(0)_{hex}$ (decimal: **0 to 4095)**

- Current values from 4 to 20 mA

  The value range:
  4 mA to 20 mA
  is displayed as follows:
  $000(0)_{hex}$ to $FFF(0)_{hex}$ (decimal: **0 to 4095)**

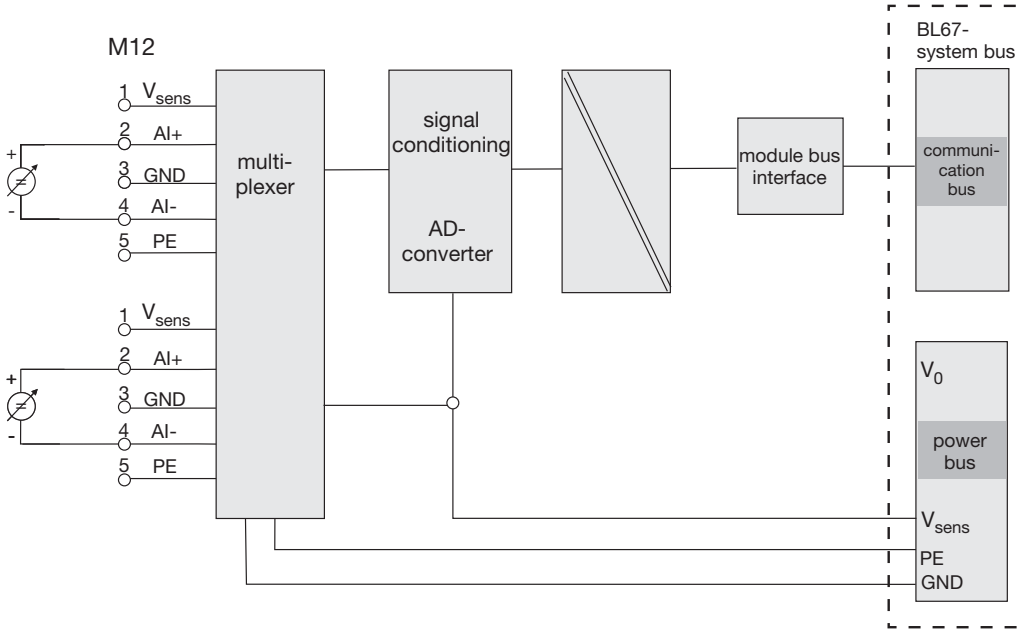
NOTE

A detailed description of the measurement value representation for the analog input modules in 16 or 12 bit can be found in the Appendix of this manual, page 15-8.

6.3 BL67-2AI-V, -10/0 ... +10 VDC

Figure 6-9:
BL67-2AI-V

Figure 6-10:
Block diagram



6.3.1 Technical data

Table 6-7: Technical data

Designation	BL67-2AI-V
No. of channels	2
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 35 mA
Nominal current from supply terminal (field) I_L	≤ 12 mA
Power loss of the module, typical P_{MAX}	< 1 W
Input voltage	-10/0 to +10 VDC
Max. output voltage	35 V continuous
Isolation voltage	
U_{TMB} (module bus/field)	min. 500 V_{eff}
U_{Fe} (field/functional earth)	min. 50 V_{AC}
channel/channel	none
channel/field supply	none
channel/system supply	500 V_{eff}
Input resistance (burden)	< 98,5 kΩ
Cutoff frequency (-3 dB)	≥ 50 Hz
Basic error at 23 °C/73.4 °F	± 0,2 %
Repeat accuracy	0,05 %
Temperature coefficient	≤ 150 ppm/°C
Resolution of the A/D converter	16 bit
Measuring principle	Delta Sigma
Measurement value representation	– 16 Bit: two's complement coded or – 12 bit left-justified two's complement (even negative values possible) binary number without coding (only positive values possible)
I_{SENS} (sensor supply from V_{sens})	≤ 250 mA; short-circuit protected in gateway or Power Feeding module

6.3.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	AI0 LSB							
	n + 1	AI0 MSB							
	n + 2	AI1 LSB							
	n + 3	AI1 MSB							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 6-8: Process data bits

Process data	Meaning
AI1 LSB	low byte of the analog value
AIx MSB	high byte of the analog value

6.3.3 Diagnostic and status messages

LED status displays

Table 6-9: LED status displays

LED	Display	Meaning	Remedy
D	red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–

Diagnostic data

This module has the following diagnostic data available **per channel**:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	-	Wire break	Measured value out of range

Table 6-10: Diagnostics

Diagnostics	Meaning
Measured value out of range	Indicates an over- or undervoltage of 1 % of the set voltage range.
Overvoltage: – U_{max} (U > 10,1 V)	
Undervoltage: – U_{min} (U < -10,1 V) for -10 bis +10 VDC – U_{min} (U < -0,1 V) for 0 bis +10 VDC	

NOTE

In the 12-bit-representation (left-justified) the diagnostic data are transmitted with the lower nibble of the process data for the respective channel.

6.3.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Measurement range
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	Deactivate diagnostics
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	reserved
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
Channel 1	Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Measurement range
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	Deactivate diagnostics
		Bit 3		Bit 11		Bit 3	Deactivate channel
		Bit 4		Bit 12		Bit 4	reserved
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

Table 6-11: Module parameters

A *default setting*

Parameter name	Value
Measurement range	0 = 0 … 10 V **A**
	1 = -10 … +10 V
Data format	0 = 15 bit + sign **A**
	1 = 12 bit (left-justified)
Deactivate diagnostics	0 =no **A**
	1 = yes
Deactivate channel	0 =no **A**
	1 = yes

6.3.5 Base modules/pin assignment

- BL67-B-2M12

Figure 6-11: BL67-B-2M12

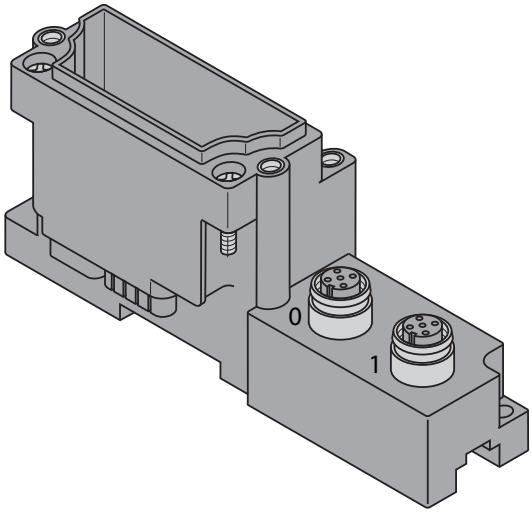
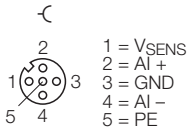


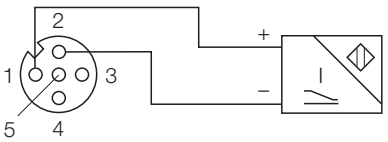
Table 6-12: Pin assignment BL67-2AI-V



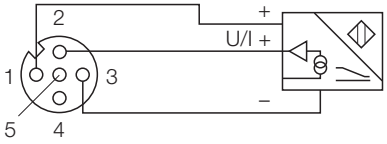
1 = V_{SENS}
2 = AI +
3 = GND
4 = AI –
5 = PE

Figure 6-12: Wiring diagrams BL67-2AI-V

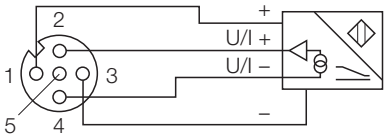
2-wire sensor with sensor supply via base module:



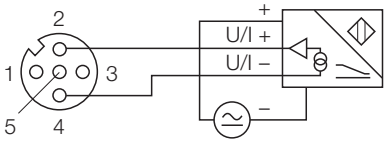
3-wire sensor with sensor supply via base module:



4-wire sensor with sensor supply via base module:



4-wire sensor with external sensor supply:



6.3.6 Measurement value representation

16-bit-representation

- Voltage values from 0 to 10 VDC

  The value range:
  0 VDC to 10 VDC
  is displayed as follows:
  0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

- Voltage values from -10 to 10 V DC

  The value range:
  -10 V to -3,052 10^{-4} V
  is displayed as follows:
  8000_{hex} to $FFFF_{hex}$ (decimal:-32768 to -1)

  The value range:
  0 V to 10 V
  is displayed as follows:
  0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

12-bit-representation (left-justified)

- Voltage values from 0 to 10 VDC

  The value range:
  0 V to 10 V
  is displayed as follows:
  $000(0)_{hex}$ to $FFF(0)_{hex}$ (decimal: **0 to 4095)**

- Voltage values from -10 to 10 VDC

  The value range:
  0 V to 10 V
  is displayed as follows:
  $000(0)_{hex}$ bis $7FF(0)_{hex}$ (decimal: **0 to 2047)**

  The value range:
  -10 V to -0.0049 V
  is displayed as follows:
  $800(0)_{hex}$ to $FFF(0)_{hex}$ (decimal: **-2048 to -1)**

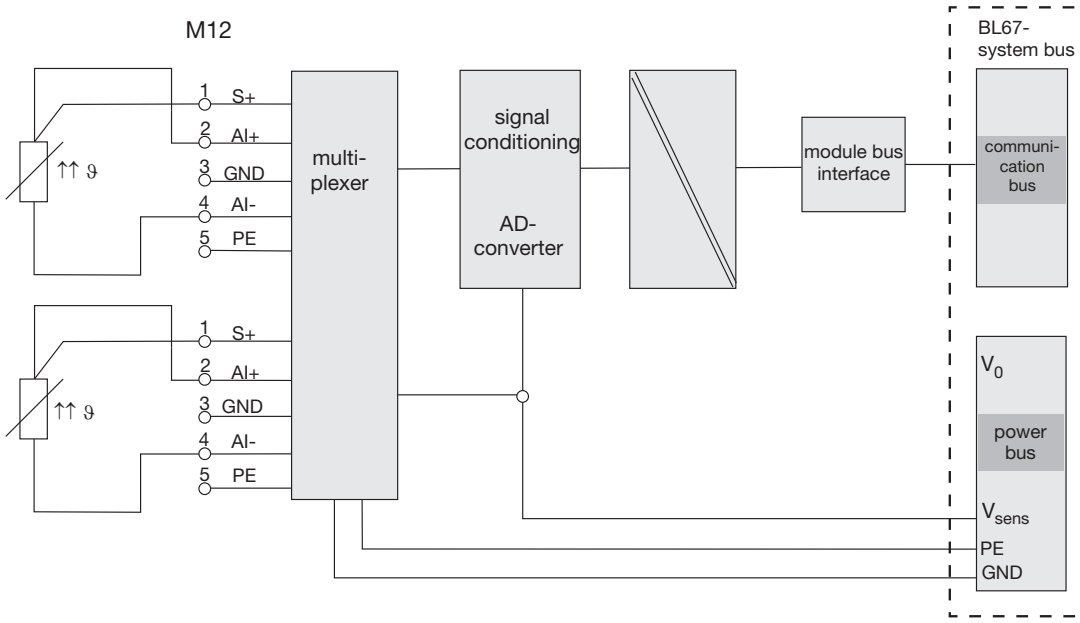
NOTE

A detailed description of the measurement value representation for the analog input modules in 16 or 12 bit can be found in the Appendix of this manual, page 15-8.

6.4 BL67-2AI-PT, Pt-/Ni-sensors

Figure 6-13:
BL67-2AI-PT

Figure 6-14:
Block diagram



6.4.1 Technical data

Table 6-13: Technical data

Designation	BL67-2AI-PT
No. of channels	2
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 45 mA
Nominal current from supply terminal (field) I_L	≤ 30 mA
Power loss of the module, typical P_{MAX}	< 1 W
Measurement current	< 1 mA
Max. input voltage U_{max} (destruction limit)	> 30 VDC
Isolation voltage	
U_{TMB} (module bus/field)	min. 500 V_{eff}
U_{Fe} (field/functional earth)	min. 50 V_{AC}
channel/channel	none
channel/field supply	none
channel/system supply	500 V_{eff}
Platinum sensors	according to DIN IEC 751
Nickel sensors	according to DIN 43 760
Measurement value representation	– 16 Bit: two's complement coded or – 12 bit left-justified two's complement (even negative values possible) binary number without coding (only positive values possible)
Offset error	± 0,1 %
Linearity	< 0.1 %
Basic error at 23 °C/73.4 °F	± 0,2 % from end value
Repeat accuracy	0,05 %
Temperature coefficient	≤ 300 ppm/°C from end value
t_{CYCL} (cycle time)	≤ 130 ms per channel
Connectable sensors	
Platinum sensors	Pt100, Pt200, Pt500, Pt1000
Nickel sensors	Ni100, Ni1000

6.4.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	AI0 LSB							
	n + 1	AI0 MSB							
	n + 2	AI1 LSB							
	n + 3	AI1 MSB							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 6-14: Process data bits

Process data	Meaning
AI1 LSB	low byte of the analog value
AIx MSB	high byte of the analog value

6.4.3 Diagnostic and status messages

LED status displays

Table 6-15: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–

6.4.4 Diagnostic data

This module has the following diagnostic data **per channel**:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	Overcurrent	Wire break	Measured value out of range

Table 6-16: Diagnostics

Diagnostics	Meaning
Measured value out of range	Threshold: 1 % of positive measurement range end value. Underflow diagnostics in temperature measurement ranges only.
Wire break	
Overcurrent	Threshold: 5 Ω (loop resistance) In temperature measurement ranges only

NOTE

In 3-wire measurement with PT100- sensor and at temperatures of below -177 °C, the module can not distinguish between overcurrent and wire break. In this case, the diagnostic "overcurrent" is generated.

6.4.5 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Mains suppression
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	Deactivate diagnostics
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	RTD type
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Measurement mode
		Bit 1		Bit 9		Bit 1	reserved
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
Channel 1	Byte 2	Bit 0	Word 1	Bit 0	Byte 2	Bit 0	Mains suppression
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	Deactivate diagnostics
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	RTD type
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	Mains suppression
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	Deactivate diagnostics
		Bit 3		Bit 11		Bit 3	Deactivate channel
		Bit 4		Bit 12		Bit 4	RTD type
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

Table 6-17: Module parameters

A *default setting*

Parameter name	Value
Mains suppression	0 = 50 Hz **A**
	1 = 60 Hz
Data format	0 = 15 bit + sign **A**
	1 = 12 bit (left-justified)
Deactivate diagnostics	0 =no **A**
	1 = yes
Deactivate channel	0 =no **A**
	1 = yes
RTD type	0000 = Pt100, -200 … 850 °C**A** 0001 = Pt100, -200 … 150 °C 0010 = Ni100, -60 … 250 °C 0011 = Ni100, -60 … 150 °C 0100 = Pt200, -200 … 850 °C 0101 = Pt200, -200 … 150 °C 0110 = Pt500, -200 … 850 °C 0111 = Pt500, -200 … 150 °C 1000 = Pt1000, -200 … 850 °C 1001 = Pt1000, -200 … 150 °C 1010 = Ni1000, -60 … 250 °C 1011 = Ni1000, -60 … 150 °C 1100 = resistance, 0 … 100 Ω 1101 = resistance, 0 … 200 Ω 1110 = resistance, 0 … 400 Ω 1111 = resistance, 0 … 1000 Ω
Measurement mode	0 = 2 wire **A**
	1 = 3 wire

6.4.6 Base modules/pin assignment

- BL67-B-2M12

Figure 6-15:
BL67-B-2M12

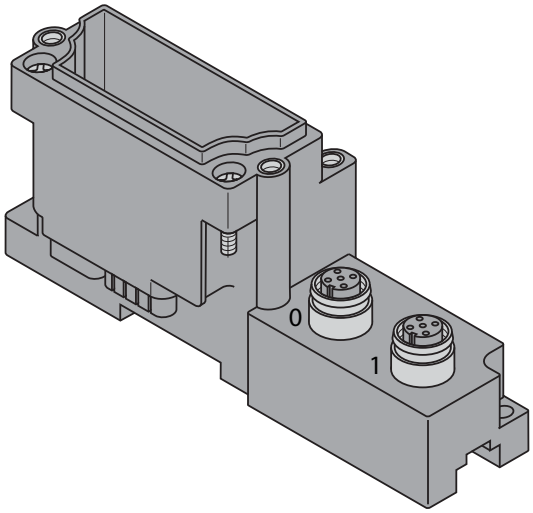
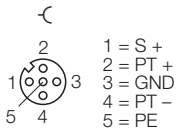


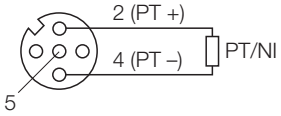
Table 6-18:
Pin assignment
BL67-2AI-PT



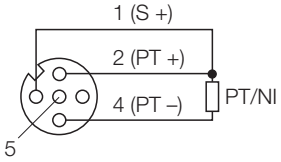
1 = S +
2 = PT +
3 = GND
4 = PT –
5 = PE

Table 6-19:
Wiring diagrams
BL67-2AI-PT

2-wire-connection technology:



3-wire-connection technology:



6.4.7 Measurement value representation

16-bit-representation

- For the parameterization
  "Pt100, -200 … 850 °C"
  "Ni100, -60 … 250 °C"
  "Pt200, -200 … 850 °C"
  "Pt500, -200 … 850 °C"
  "Pt1000, -200 … 850 °C"
  "Ni1000, -60 … 250 °C"

  The value range:
  -200 °C to -0,1 °C
  is displayed as follows:
  F830$_{hex}$ to FFFF$_{hex}$ (decimal: -2000 to -1)

  The value range:
  0 °C to 850 °C
  is displayed as follows:
  0000$_{hex}$ to 2134$_{hex}$ (decimal: **0 to 8500)**

- For the parameterization
  "Pt100, -200 … 150 °C"
  "Ni100, -60 … 150 °C"
  "Pt200, -200 … 150 °C"
  "Pt500, -200 … 150 °C"
  "Pt1000, -200 … 150 °C"
  "Ni1000, -60 … 150 °C"

  The value range:
  -200 °C to -0,01 °C
  is displayed as follows:
  B1E0$_{hex}$ to FFFF$_{hex}$ (decimal: -20000 to -1)

  The value range:
  0 °C to 150 °C
  is displayed as follows:
  0000$_{hex}$ to 3A98$_{hex}$ (decimal: 0 to 15000)

- For representation of resistance values only positive numbers (hexadecimal/binary) are used. The positive values can easily be converted into decimal ones.

  The value range:
  0 to 100 Ω; 0 to 200 Ω; 0 to 400 Ω; 0 to 1000 Ω
  is displayed as follows:
  0000$_{hex}$ to 7FFF$_{hex}$ (decimal: 0 to 32767)

12-bit-representation (left-justified)

- For the parameterization
  "Pt100, -200 … 850 °C"
  "Ni100, -60 … 250 °C"
  "Pt200, -200 … 850 °C"
  "Pt500, -200 … 850 °C"
  "Pt1000, -200 … 850 °C"
  "Ni1000, -60 … 250 °C"

  The value range:
  -200 °C to -0,5 °C
  is displayed as follows:
  E70(0)$_{hex}$ bis FFF(0)$_{hex}$ (decimal: **-400 to -1)**

  The value range:
  0 °C to 850 °C
  is displayed as follows:
  000(0)$_{hex}$ bis 6A4(0)$_{hex}$ (decimal: **0 to 1700)**

- For the parameterization

  "Pt100, -200 … 150 °C"
  "Ni100, -60 … 150 °C"
  "Pt200, -200 … 150 °C"
  "Pt500, -200 … 150 °C"
  "Pt1000, -200 … 150 °C"
  "Ni1000, -60 … 150 °C"

  The value range:
  -200 °C to -0,1 °C
  is displayed as follows:
  830(0)$_{hex}$ bis FFF(0)$_{hex}$ (decimal: **-2000 to -1)**

  The value range:
  0 °C to 150 °C
  is displayed as follows:
  000(0)$_{hex}$ bis 5DC(0)$_{hex}$ (decimal: **0 to 1500)**

- For the parameterization in the **resistance value** measurement, only positive numbers (hexadecimal/binary) are used. The positive values can easily be converted into decimal ones.

  The value range:
  0 Ω to 100 Ω;
  0 Ω to 200 Ω;
  0 Ω to 400 Ω;
  0 Ω to 1000 Ω;
  is displayed as follows:
  $000(0)_{hex}$ bis $FFF(0)_{hex}$ (decimal: 0 to 4095).

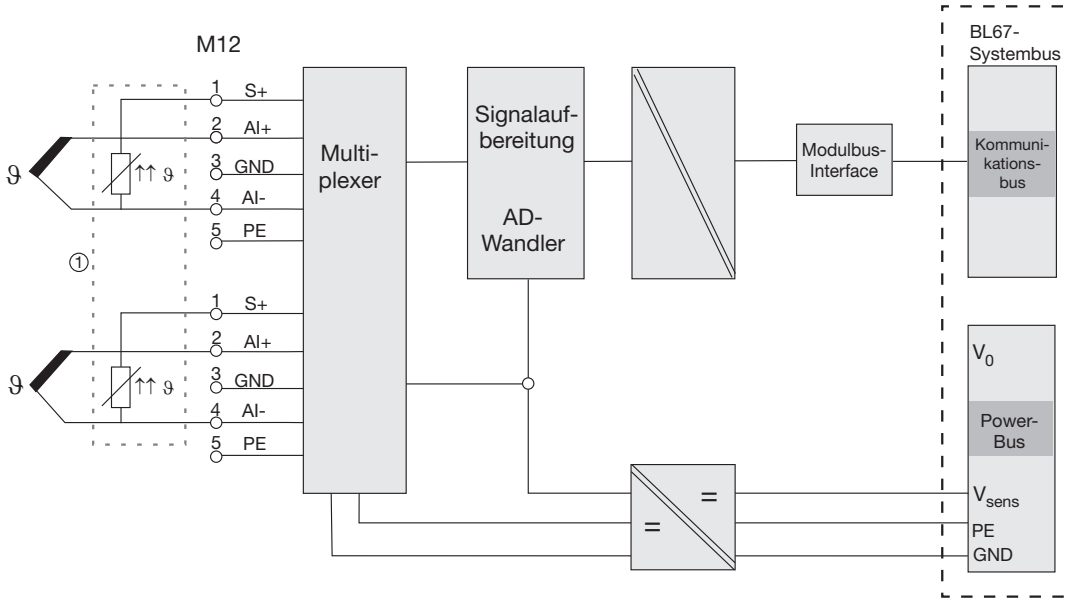
NOTE

A detailed description of the measurement value representation for the analog input modules in 16 or 12 bit can be found in the Appendix of this manual, page 15-8.

6.5 BL67-2AI-TC, thermo couples

Figure 6-16:
BL67-2AI-TC

Figure 6-17:
Block diagram



① Kaltstellenkompensations-Messwiderstand (Pt1000) im Stecker

6.5.1 Technical data

Table 6-20: Technical data

Designation	BL67-2AI-TC
No. of channels	2
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 35 mA
Nominal current from supply terminal (field) I_L	≤ 30 mA
Power loss of the module, typical P_{MAX}	< 1 W
Input voltage	≥ 10 VDC (permanent)
Isolation voltage	
U_{TMB} (module bus/field)	min. 500 V_{eff}
U_{Fe} (field/functional earth)	min. 50 V_{AC}
channel/channel	none
channel/field supply	500 V_{eff}
channel/system supply	500 V_{eff}
Sensors	according to IEC 584, class 1, 2, 3
Temperature ranges	
Type B Type E Type J Type K Type N Type R Type S Type T	100 to 1820,0 °C -270 to 1000,0 °C -210 to 1200,0 °C -270 to 1370,0 °C -270 to 1300,0 °C -50 to 1760,0 °C -50 to 1540,0 °C -270 to 400,0 °C
Voltage measurement (resolution)	
± 50 mV ± 100 mV ± 500 mV ± 1 V	< 2 µV < 4 µV < 20 µV < 50 µV
Measurement value representation	16 bit signed integer/ 12 bit full range, left-justified
at 23 °C	see Table 6-21:

	Crosstalk suppression	≥ 80 dB
	Repeat accuracy	see Table 6-22:.
	Temperature coefficient T_K	≤ 300 ppm/°C from end value
	Cycle time	Voltage measurement: 70 ms/channel Temperature measurement: 130 ms/channel

Table 6-21: Basic errors

Thermo couple	Temperature range/°C	Basic error at 23 °C/% of positive end value
Type K	-200 … 1370	± 0,2
Type J	-210 … 1200	± 0,2
Type B	500 … 1820	± 0,2
Type N	-150 … 1300	± 0,2
Type E	-180 … 1000	± 0,2
Type R	0 … 1760	± 0,2
Type S	0 … 1540	± 0,2
Type T	-200 … 0 0 … 400	± 0,6 ± 0,2
Voltage measurement	all measurement ranges	± 0,2

Table 6-22: Repeat accuracies

Thermo couple	Repeat accuracy/% of positive end value	Error due to cold junction compensation/% of positive end value
Type K	0.05	± 0,15
Type J	0.05	± 0,17
Type B	0.05	± 0,11
Type N	0.05	± 0,16
Type E	0.05	± 0,20
Type R	0.05	± 0,12
Type S	0.05	± 0,13
Type T	0.1 0.075	– 0
Voltage measurement	0.05	–

NOTE

Wider deviations of the cold junction compensation are to be expected for lower temperatures.

6.5.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	AI0 LSB							
	n + 1	AI0 MSB							
	n + 2	AI1 LSB							
	n + 3	AI1 MSB							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 6-23: Process data bits

Process data	Meaning
AI1 LSB	low byte of the analog value
AIx MSB	high byte of the analog value

6.5.3 Diagnostic and status messages

LED status displays

Table 6-24: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–

Diagnostic data

This module has the following diagnostic data **per channel**:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	Cold junction compensation wire break	Wire break	Measured value out of range

Table 6-25: Diagnostics

Diagnostics	Meaning
Measured value out of range	Threshold: 1 % of positive measurement range end value
Wire break Threshold: negative transformer end value	In temperature measurement ranges only
Cold junction compensation wire break	If no Pt1000 sensor is detected, a cold junction temperature of 23 °C is automatically presumed.

6.5.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Mains suppression
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	Deactivate diagnostics
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	Thermocouple type
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
Channel 1	Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Mains suppression
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	Deactivate diagnostics
		Bit 3		Bit 11		Bit 3	Deactivate channel
		Bit 4		Bit 12		Bit 4	Thermocouple type
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

Table 6-26: Module parameters

A *default setting*

Parameter name	Value
Mains suppression	0 = 50 Hz **A**
	1 = 60 Hz
Data format	0 = 15 bit + sign **A**
	1 = 12 bit (left-justified)
Deactivate diagnostics	0 =no **A**
	1 = yes
Deactivate channel	0 =no **A**
	1 = yes
Thermocouple type	0000 = Type K, -270 … 1370 °C**A** 0001 = Type B, +100 … 1820 °C 0010 = Type E, -270 … 1000 °C 0011 = Type J, -210 … 1200 °C 0100 = Type N, -270 … 1300 °C 0101 = Type R, -50 … 1760 °C 0110 = Type S, -50 … 1540 °C 0111 = Type T, -270 … 400 °C 1000 = +/-50 mV 1001 = +/-100 mV 1010 = +/-500 mV 1011 = +/-1000 mV

6.5.5 Base modules/pin assignment

- BL67-B-2M12

Figure 6-18:
BL67-B-2M12

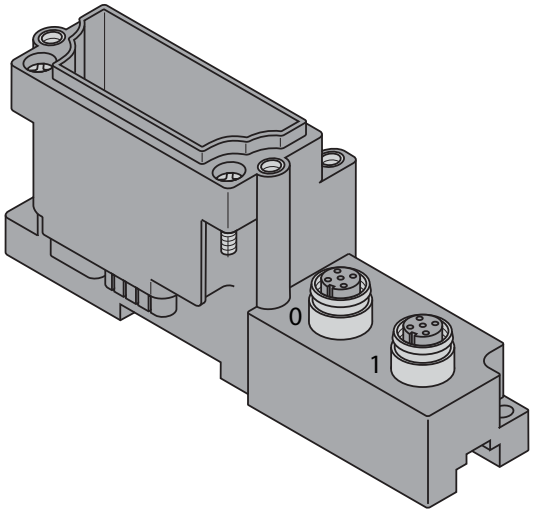
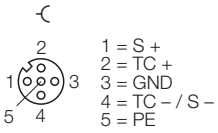
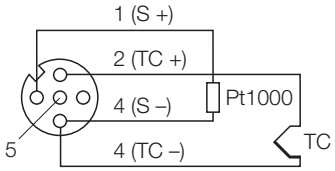


Table 6-27:
Pin assignment
BL67-2AI-TC



S = PT1000 sensor for cold junction compensation
TC = thermo couple

Table 6-28:
Wiring diagram
BL67-2AI-TC



Suitable connector with a Pt1000 for the cold-junction compensation:
BL67-WAS5-THERMO

6.5.6 Measurement value representation

16-bit-representation

- For the parameterization
  "Type K, -270 … 1370 °C"
  "Type B, +100 … 1820 °C"
  "Type E, -270 … 1000 °C"
  "Type J, -210 … 1200 °C"
  "Type N, -270 … 1300 °C"
  "Type R, -50 … 1760 °C"
  "Type S, -50 … 1540 °C"
  "Type T, -270 … 400 °C"

  The value range:
  -270 °C to -0,1°C
  is displayed as follows:
  $F574_{hex}$ to $FFFF_{hex}$ (decimal: -2700 to -1)

  The value range:
  0 °C to 1820 °C
  is displayed as follows:
  0000_{hex} to 4718_{hex} (decimal: **0 to 18200)**

  The value range:
  -50 mV to -0,002 mV;
  -100 mV to -0,003 mV;
  -500 mV to -0,015 mV;
  -1000 mV to -0.031 mV
  is displayed as follows:
  8000_{hex} to $FFFF_{hex}$ (decimal: -32768 to -1)

  The value range:
  0 mV to 50 mV;
  0 mV to 100 mV;
  0 mV to 500 mV;
  0 mV to 1000 mV;
  is displayed as follows:
  0000_{hex} to $7FFF_{hex}$ (decimal: **0 to 32767)**

12-bit-representation (left-justified)

- For the parameterization
  "Type K, -270 … 1370 °C"
  "Type B, +100 … 1820 °C"
  "Type E, -270 … 1000 °C"
  "Type J, -210 … 1200 °C"
  "Type N, -270 … 1300 °C"
  "Type R, -50 … 1760 °C"
  "Type S, -50 … 1540 °C"
  "Type T, -270 … 400 °C"

  The value range:
  -270 °C to 1820 °C
  is displayed as follows:
  EF2(0)$_{hex}$ bis 71C(0)$_{hex}$ (decimal: **-270 to 1820)**

  The value range:
  -50 mV to -0,024 mV;
  -100 mV to -0,049 mV;
  -500 mV to -0,244 mV;
  -1000 mV to -0,489 mV;
  is displayed as follows:
  800(0)$_{hex}$ to FFF(0)$_{hex}$ (decimal: **-2048 to -1)**

  The value range:
  0 mV to 50 mV;
  0 mV to 100 mV;
  0 mV to 500 mV;
  0 mV to 1000 mV;
  is displayed as follows:
  000(0)$_{hex}$ bis 7FF(0)$_{hex}$ (decimal: **0 to 2047)**

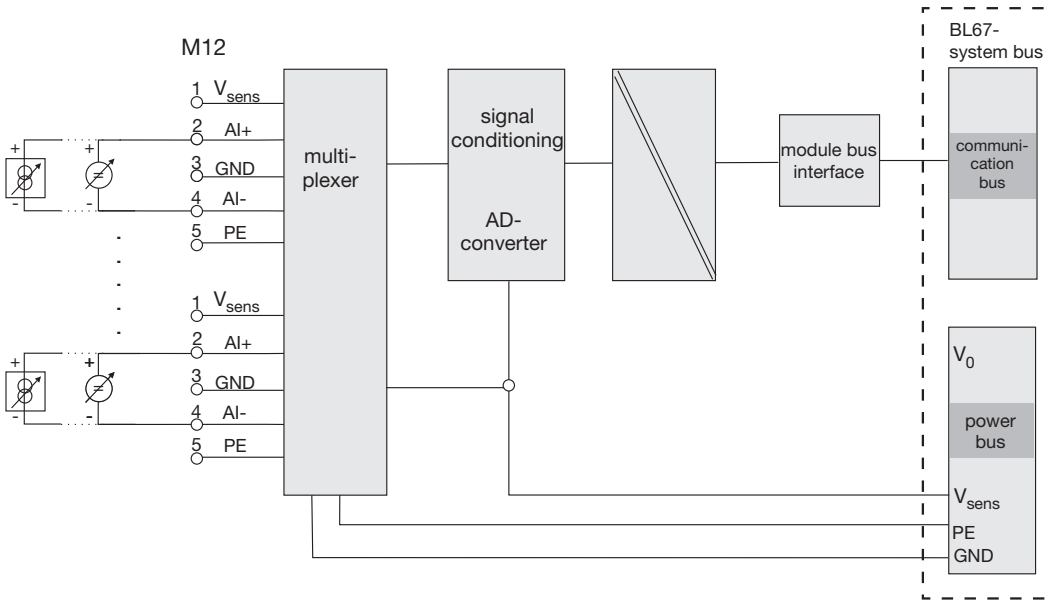
NOTE

A detailed description of the measurement value representation for the analog input modules in 16 or 12 bit can be found in the Appendix of this manual, page 15-8.

6.6 BL67-4AI-V/I, voltage-/current measurement

Figure 6-19:
BL67-4AI-V/I

Figure 6-20:
Block diagram



6.6.1 Technical data

Table 6-29: Technical data

Designation	BL67-4AI-V/I
No. of channels	4
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 35 mA
Nominal current from supply terminal (field) I_L	≤ 12 mA
Power loss of the module, typical P_{MAX}	< 1 W
Input signal in current measurement	
Input resistance (burden)	< 125 Ω
Input current (range which can be evaluated by the A/D converter)	0 to 20 mA 4 to 20 mA
Input current (maximum - an "Measured value out of range" is shown if the current is above 20.2 mA)	50 mA
Cutoff frequency (-3 dB)	20 Hz
Input signal in voltage measurement	
Input resistance (burden)	> 98,5 kΩ
Input voltage (range which can be evaluated by the A/D converter)	-10 to 10 VDC 0 to 10 VDC
Input voltage (maximum - a deviation of 1 % already generates a "Measured value out of range" message)	35 VDC
Cutoff frequency (-3 dB)	20 Hz
Isolation voltage	
U_{TMB} (module bus/field)	min. 500 V_{eff}
U_{Fe} (field/functional earth)	min. 50 V_{AC}
channel/channel	none
channel/field supply	none
channel/system supply	500 V_{eff}
accuracy for the input signal	
Basic error at 23 °C/73.4 °F	± 0,3 %

Temperature coefficient	≤ 300 ppm/°C from end value
Resolution of the A/D converter	16 bit
Measuring principle	Delta Sigma
Measurement value representation	– 16 Bit: two's complement coded or – 12 bit left-justified two's complement (even negative values possible) binary number without coding (only positive values possible)

6.6.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	AI0 LSB							
	n + 1	AI0 MSB							
	n + 2	AI1 LSB							
	n + 3	AI1 MSB							
	n + 4	AI2 LSB							
	n + 5	AI2 MSB							
	n + 6	AI3 LSB							
	n + 7	AI3 MSB							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 6-30: Process data bits

Process data	Meaning
AI1 LSB	low byte of the analog value
AIx MSB	high byte of the analog value

6.6.3 Diagnostic and status messages

LED status displays

Table 6-31: LED status displays

LED	Display	Meaning	Remedy
D	red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–
0 to 4	Green	Channel x active	-
	Green flashing, 0.5 Hz	Underflow	-
	Green flashing, 4 Hz	Overflow	-
	OFF	Channel x inactive	

Diagnostic data

This module has the following diagnostic data **per channel**:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	-	Overflow/ underflow, OUFL	Wire break	Measured value out of range

NOTE

In the 12-bit-representation (left-justified) the diagnostic data are transmitted with the lower nibble of the process data for the respective channel.

Table 6-32: Diagnostics

Byte	Bit	Diagnostics	Meaning
Inputs			
0 - 3	0	Measured value out of range	Indicates an exceeding or undercut of the value ranges. The permissible measurement value limits are exceeded, it is thus possible that no valid measurement value can be detected.
	1	Wire break	Indicates an open circuit in the signal line for the operating mode: Only in current measurement 4 to 20 mA
	2	Overflow/underflow	The measurement value is below the value ranges and the device is not able to capture these values.

NOTE

In the current measurement ranges, the module switches automatically to the voltage measurement after 300 ms if I > 40.0 mA. For the 300 ms, a current of max. 500 mA is accepted. After this, a periodical switching to current measurement is done. If the current falls again to the permissible range, the module switches permanently back to current measurement. During this procedure, the transmitted value is always the measurement range end value. Please observe the module's maximum input voltage!

6.6.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Measurement range
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	Deactivate diagnostics
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	Operation mode
		Bit 5		Bit 5		Bit 5	Data representation
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	reserved
Channel 1	Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Measurement range
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	Deactivate diagnostics
		Bit 3		Bit 11		Bit 3	Deactivate channel
		Bit 4		Bit 12		Bit 4	Operation mode
		Bit 5		Bit 13		Bit 5	Data representation
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	reserved
Channel 2	Byte 2	Bit 0	Word 1	Bit 0	Byte 0	Bit 0	Measurement range
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	Deactivate diagnostics
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	Operation mode
		Bit 5		Bit 5		Bit 5	Data representation
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	reserved
Channel 3	Byte 3	Bit 0		Bit 8	Byte 1	Bit 0	Measurement range
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	Deactivate diagnostics
		Bit 3		Bit 11		Bit 3	Deactivate channel
		Bit 4		Bit 12		Bit 4	Operation mode
		Bit 5		Bit 13		Bit 5	Data representation
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	reserved

Table 6-33: Module parameters

A *default setting*
B *valid for firmware version ≥ 15*

Parameter name	Value
Measurement range	0 = 0 … 10 V/0 … 20 mA **A**
	1 = -10 … +10 V/4 … 20 mA
Data format	0 = 15 bit + sign **A**
	1 = 12 bit (left-justified)
Deactivate diagnostics	0 =no **A**
	1 = yes
Deactivate channel	0 =no **A**
	1 = yes
Operation mode	0 = voltage **A**
	1 = current
Data representation	00 = standard
	01 = NE 43 **B**
	10 = extended range **B**

NOTE

Concerning the "number representation", please observe the tables for measurement value representation on the following pages.

6.6.5 Measurement value representation

Standard value representation

- 16-bit-representation

-10 ... 0 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 3,052 × 10^{-4}) V				
> 10.1000 V		at ↑ DIA Measured value out of range ON	32767	7FFF
≤ 10.0500 V		at ↓ DIA Measured value out of range OFF	32767	7FFF
10.0000 V	nominal range		32767	7FFF
9.9997 V			32766	7FFE
…			…	…
5.0002 V			16384	4000
…			…	…
0.000305 V			1	0001
0.000000 V			0	0000
-0.000305 V			-1	FFFF
…			…	…
-5.0000 V			-16384	C000
…			…	…
-9.9997 V			-32767	8001
≤ -10.0000 V			-32768	8000
≥ -10,0500 V		at ↑ DIA Measured value out of range OFF	-32768	8000
< -10,1000 V		at ↓ DIA Measured value out of range ON	-32768	8000

0 ... 10 V	unipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 3,052 × 10^{-4}) V				
> 10.1000 V		at ↑ DIA Measured value out of range ON	32767	7FFF
≤ 10.0500 V		at ↓ DIA Measured value out of range OFF	32767	7FFF
10.0000 V	nominal range		32767	7FFF
9.9997 V			32766	7FFE
…			…	…
5.0002 V			16384	4000
…			…	…
0.000305 V			1	0001
≤ 0.000000 V			0	0000
≥ -0,0500 V		at ↑ DIA Measured value out of range OFF	0	0000
< -0,1000 V		at ↓ DIA Measured value out of range ON	0	0000

0 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 6,104 × 10^{-4}) mA				
> 20.2000 mA		at ↑ DIA Measured value out of range ON	32767	7FFF
≤ 20.1000 mA		at ↓ DIA Measured value out of range OFF	32767	7FFF
20.0000 mA	nominal range		32767	7FFF
19.9994 mA			32766	7FFE
...			...	...
10.0003 mA			16384	4000
...			...	...
0.0006104 mA			1	0001
≤ 0.0000 mA			0	0000
≥ -0.1 mA		at ↑ DIA Measured value out of range OFF	0	0000
< -0,2 mA		at ↓ DIA Measured value out of range ON	0	0000

4 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 4,883 × 10^{-4}) mA				
> 20.2000 mA		at ↑ DIA Measured value out of range ON	32767	7FFF
≤ 20.1000 mA		at ↓ DIA Measured value out of range OFF	32767	7FFF
20.0000 mA	nominal range		32767	7FFF
19.9995 mA			32766	7FFE
...			...	...
12.00024 mA			16384	4000
...			...	...
4.0004883 mA			1	0001
≤ 4.0000 mA			0	0000
≥ 3,7000 mA		at ↑ DIA Measured value out of range OFF	0	0000
< 3.6000 mA		at ↓ DIA Measured value out of range ON	0	0000
≥ 3,0000 mA		at ↑ DIA Wire break OFF	0	0000
< 2.9000 mA		at ↓ DIA Wire break ON	0	0000

- 12-bit-representation (left-justified)

NOTE

If the measurement value representation is parameterized as "12bit left-justified" the diagnostic data will be transferred with the process data bits 0 to 3 of the respective channel.

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value/16 × 4,885 × 10^{-3}) V				
> 10.1000 V		at ↑ DIA Measured value out of range ON	2047 × 16	7FFF
≤ 10.0500 V		at ↓ DIA Measured value out of range OFF	2047 × 16	7FFF
10.0000 V	nominal range		2047 × 16	7FFF
9.9951 V			2046 × 16	7FE×
…			…	…
5.00244 V			1024 × 16	400×
…			…	…
0.00488 V			1 × 16	001×
0.000000 V			0	000×
-0.000488 V			-1 × 16	FFF×
…			…	…
-5.0000 V			-1024 × 16	C00×
…			…	…
-9.99511 V			-2047 × 16	801×
≤ -10.0000 V			-2048 × 16	800×
≥ -10,0500 V		at ↑ DIA Measured value out of range OFF	-2048 × 16	800×
< -10,1000 V		at ↓ DIA Measured value out of range ON	-2048 × 16	800×

0 ... 10 V	unipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value/16 × 2,442 × 10^{-3}) V				
> 10.1000 V		at ↑ DIA Measured value out of range ON	4095 × 16	FFF×
≤ 10.0500 V		at ↓ DIA Measured value out of range OFF	4095 × 16	FFF×
10.0000 V	nominal range		4095 × 16	FFF×
9.9976 V			4094 × 16	FFE×
…			…	…
5.0012 V			2048 × 16	800×
…			…	…
0.00244 V			1 × 16	001×
≤ 0.0000 V			0	000×
≥ -0,0500 V		at ↑ DIA Measured value out of range OFF	0	000×
< -0,1000 V		at ↓ DIA Measured value out of range ON	0	000×

0 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value U_M = (dec. value/16 × 4,884 × 10^{-3}) mA				
> 20.2000 mA		at ↑ DIA Measured value out of range ON	4095 × 16	FFF×
≤ 20.1000 mA		at ↓ DIA Measured value out of range OFF	4095 × 16	FFF×
≥ 20.0000 mA	nominal range		4095 × 16	FFF×
19.9951 mA			4094 × 16	FFE×
…			…	…
10.0024 mA			2048 × 16	800×
…			…	…
0.00488 mA			1 × 16	001×
≤ 0,0000 mA			0	000×

4 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value/16 × 3,907 × 10^{-3}) + 4) mA				
> 20.2000 mA		at ↑ DIA Measured value out of range ON	4095 × 16	FFF×
≤ 20.1000 mA		at ↓ DIA Measured value out of range OFF	4095 × 16	FFF×
≥ 20.0000 mA	nominal range		4095 × 16	FFF×
19.9961 mA			4094 × 16	FFE×
…			…	…
12.0020 mA			2048 × 16	800×
…			…	…
4.0039 mA			1 × 16	001×
≤ 4.0000 mA			0	000×
≥ 3,7000 mA		at ↑ DIA Measured value out of range OFF	0	000×
< 3,6000 mA		at ↓ DIA Measured value out of range ON	0	000×
≥ 3,0000 mA		at ↑ DIA Wire break OFF	0	000×
< 2,9000 mA		at ↓ DIA Wire break ON	0	000×

Extended range - value representation

- 16-bit-representation

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 3,617 × 10^{-4}) V				
≥ 11.851490 V	overflow		32767	7FFF
≥ 11.758773 V		at ↑ DIA Measured value out of range ON	32512	7F00
11.7584 V	over-steering		32511	7EFF
≤ 11.603010 V		at ↓ DIA Measured value out of range OFF	32080	7D50
10.000305 V			27649	6C01
10.000000 V	nominal range		27648	6C00
…			…	…
5.0000 V			13824	3600
…			…	…
0.0003617 V			1	0001
0.000000 V			0	0000
-0.0003617 V			-1	FFFF
…			…	…
-5.000000 V			-13824	CA00
…			…	…
-10.000000V			-27648	9400
-10.000362 V	under-steering		-27649	93FF
≥ -11,60301 V		at ↑ DIA Measured value out of range OFF	-32080	82B0
-11.758897 V			-32511	8100
-11.759259 V	underflow	at ↓ DIA Measured value out of range ON	-32512	80FF
≤ -11.851851 V			-32768	8000

0...10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 3,617 × 10^{-4}) V				
≥ 11.851490 V	overflow		32767	7FFF
≥ 11.758773 V		at ↑ DIA Measured value out of range ON	32512	7F00
11.7584 V	over-steering		32511	7EFF
≤ 11.603010 V		at ↓ DIA Measured value out of range OFF	32080	7D50
10.000305 V			27649	6C01
10.000000 V	nominal range		27648	6C00
…			…	…
5.0000 V			13824	3600
…			…	…
0.000361 V			1	0001
0.000000 V			0	0000
< 0,000000 V			0	0000
≥ -0,050 V	underflow	at ↑ DIA Overflow/underflow OFF	0	0000
< -0,100 V		at ↓ DIA Overflow/underflow ON	0	0000

0 ... 20 mA	bipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 7,234 × 10^{-4}) mA				
≥ 23.70298 mA	overflow		32767	7FFF
≥ 23.5185 mA		at ↑ DIA Measured value out of range ON	32512	7F00
23.517795 mA	over-steering		32511	7EFF
≤ 23.2060 mA		at ↓ DIA Measured value out of range OFF	32080	7D50
20.000723 mA			27649	6C01
20.000000 mA	nominal range		27648	6C00
...			...	...
10.0000 mA			13824	3600
...			...	...
0.0007234 mA			1	0001
0.000000 mA			0	0000

4 ... 20 mA	bipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 5,787 × 10^{-4}) mA				
≥ 22.96238 mA	overflow		32767	7FFF
≥ 22.81481 mA		at ↑ DIA Measured value out of range ON	32512	7F00
22.814236 mA	over-steering		32511	7EFF
≤ 22.56482 mA		at ↓ DIA Measured value out of range OFF	32080	7D50
20.000579 mA			27649	6C01
20.000000 mA	nominal range		27648	6C00
...			...	...
12.0000 mA			13824	3600
...			...	...
4.0005787 mA			1	0001
4.000000 mA			0	0000
3.999421 mA	under-steering		-1	FFFF
≥ 1.30324 mA		at ↑ DIA Measured value out of range OFF	-4672	EDC0
1.185185			-4864	ED00
≤ 1.184606 mA	underflow	at ↓ DIA Measured value out of range ON	-4865	ECFF
≤ 0.0000 mA			-6912	E500

- 12-bit-representation (left-justified)

The representation of the 12 bit values corresponds to that of the 16 bit values. Only bits 0 to 3 are set to "0". Diagnostic data are not mapped to the process data.

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value/16 × 5,787 × 10^{-3}) V				
≥ 11.8460 V	overflow		2047 × 16	7FF0
≥ 11.7592 V		at ↑ DIA Measured value out of range ON	2032 × 16	7F00
11.7535 V	over-steering		2031 × 16	7EF0
≤ 11.6030 V		at ↓ DIA Measured value out of range OFF	2005 × 16	7D50
10.0058 V			1729 × 16	6C10
10.000000 V	nominal range		1728 × 16	6C00
…			…	…
5.0000 V			864 × 16	3600
…			…	…
0.000578 V			1 × 16	0010
0.000000 V			0	0000
-0.000578 V			-1 × 16	FFF0
…			…	…
-5.000000 V			-864 × 16	CA00
…			…	…
-10.000000V			-1728 × 16	9400
-10.0058 V	under-steering		-1729 × 16	93F0
≥ -11,6030 V		at ↑ DIA Measured value out of range OFF	-2005 × 16	82B0
-11.7592 V			-2032 × 16	8100
-11.7650 V	underflow	at ↓ DIA Measured value out of range ON	-2033 × 16	80F0
≤ -11.8518 V			-2048 × 16	8000

0 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value/16 × 5,787 × 10^{-3}) V				
≥ 11.8460 V	overflow		2047 × 16	7FF0
≥ 11.7592 V		at ↑ DIA Measured value out of range ON	2032 × 16	7F00
11.7535 V	over-steering		2031 × 16	7EF0
≤ 11.6030 V		at ↓ DIA Measured value out of range OFF	2005 × 16	7D50
10.0058 V			1729 × 16	6C10
10.000000 V	nominal range		1728 × 16	6C00
…			…	…
5.0000 V			864 × 16	3600
…			…	…
0.000578 V			1 × 16	0010
0.00000 V			0	0000
≥ -0.050 V	underflow	at ↑ DIA Overflow/underflow OFF	0	0000
< -0,100 V		at ↓ DIA Overflow/underflow ON	0	0000

0 ... 20 mA	bipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value/16 × 0,01157) mA				
≥ 23.6921 mA	overflow		2047 × 16	7FF0
≥ 23.5185 mA		at ↑ DIA Measured value out of range ON	2032 × 16	7F00
23.5069 mA	over-steering		2031 × 16	7EF0
≤ 23.2060 mA		at ↓ DIA Measured value out of range OFF	2005 × 16	7D50
20.0116 mA			1729 × 16	6C10
20.000000 mA	nominal range		1728 × 16	6C00
...			...	...
10.0000 mA			864 × 16	3600
...			...	...
0.01157 mA			1 × 16	0010
≤ 0.0000 mA			0	0000
≥ -0,1 mA	underflow	at ↑ DIA Overflow/underflow OFF	0	0000
< -0,2 mA		at ↓ DIA Overflow/underflow ON	0	0000

4 ... 20 mA	bipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value/16 × 9,259 × 10^{-3}) + 4) mA				
≥ 22.9537 mA	overflow		2047 × 16	7FF0
≥ 22.8148 mA		at ↑ DIA Measured value out of range ON	2032 × 16	7F00
22.8056 mA	over-steering		2031 × 16	7EF0
≤ 22.5648 mA		at ↓ DIA Measured value out of range OFF	2005 × 16	7D50
20.0093 mA			1729 × 16	6C10
20.000000 mA	nominal range		1728 × 16	6C00
...			...	...
12.0000 mA			864 × 16	3600
...			...	...
4.00925 mA			1 × 16	0010
40000 mA			0	0000
3,9907 mA	under-steering		-1 × 16	FFF0
≥ 1.2963 mA		at ↑ DIA Measured value out of range OFF	-292 × 16	EDC0
1.1851 mA			-304 × 16	ED00
≤ 1.1759 mA	underflow	at ↓ DIA Measured value out of range ON	-305 × 16	ECF0
≤ 0.000 mA			-432 × 16	E500

Value representation process automation (NE 43)

- 16-bit-representation

The hexadecimal value transmitted by the module has to be interpreted as decimal value, which corresponds, if multiplied with a defined factor, to the analog value.

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 0,001) V				
≥ 11,000 V	overflow		11000	2AF8
≤ 10.999 V			10999	2AF7
≥ 10.500 V	over-steering	at ↑ DIA Measured value out of range ON	10500	2904
≤ 10.250 V		at ↓ DIA Measured value out of range OFF	10250	280A
10.001 V			10001	2711
10.000 V	nominal range		10000	2710
…			…	…
5.000 V			5000	1388
…			…	…
0.001 V			1	0001
0.000 V			0	0000
-0.001 V			-1	FFFF
…			…	…
-5.0000 V			-5000	EC78
…			…	…
-10.000 V			-10000	D8F0
- 10,001 V	under-steering		-10001	D8EF
-10.250 V		at ↑ DIA Measured value out of range OFF	-10250	D7F6
-10.500 V		at ↓ DIA Measured value out of range ON	-10500	D6FC
-10.501 V	underflow		-10501	D6FB
-10.999 V			-10999	D509
≤ -11.000 V			-11000	D508

0 ... 10 V	unipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 0,001) V				
≥ 11,000 V	overflow		11000	2AF8
≤ 10,999 V			10999	2AF7
≥ 10.500 V	over-steering	at ↑ DIA Measured value out of range ON	10500	2904
≤ 10.250 V		at ↓ DIA Measured value out of range OFF	10250	280A
10.001 V			10001	2711
10.000 V	nominal range		10000	2710
...			...	...
5.000 V			5000	1388
...			...	...
0.001 V			1	0001
0.000 V			0	0000
≥ - 0,05 V	underflow	at ↑ DIA Measured value out of range OFF	0	0000
< -0,10 V		at ↓ DIA Measured value out of range ON	0	0000

0 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 0,001) mA				
≥ 22,000 mA	overflow	at ↑ DIA Overflow/underflow ON	22000	55F0
≤ 21.999 mA		at ↓ DIA Overflow/underflow OFF	21999	55EF
21.001 mA			21001	5209
≥ 21.000 mA	over-steering	at ↑ DIA Measured value out of range ON	21000	5208
≤ 20.500 mA		at ↓ DIA Measured value out of range OFF	20500	5014
20.001 mA			20001	4E21
20.000 mA	nominal range		20000	4E20
...			...	...
10.000 mA			10000	2712
...			...	...
0.001 mA			1	0001
0.0000 mA			0	0000

4 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 0,001) mA				
≥ 22,000 mA	overflow	at ↑ DIA Overflow/under-flow ON	22000	55F0
≤ 21.999 mA		at ↓ DIA Overflow/under-flow OFF	21999	55EF
21.001 mA			21001	5209
≥ 21.000 mA	over-steering	at ↑ DIA Measured value out of range ON	21000	5208
≤ 20.500 mA		at ↓ DIA Measured value out of range OFF	20500	5014
20.001 mA			20001	4E21
20.000 mA	nominal range		20000	4E20
…			…	…
12.000 mA			12000	2EE0
…			…	…
4.001 mA			4001	0FA1
4.000 mA			4000	0FA0
3.999 mA	under-steering		3999	0F9F
≥ 3.800 mA		at ↑ DIA Measured value out of range OFF	3800	0ED8
3.600 mA		at ↓ DIA Measured value out of range ON	3600	0E10
3.599 mA	underflow		3599	0E0F
≥ 2,001 mA		at ↑ DIA Wire break OFF	2001	07D1
≤ 2.000 mA		at ↓ DIA Wire break ON	2000	07D0
0.000 mA			0000	0000

- 12-bit-representation (left-justified)

The 12-bit-representation (left-justified) in process automation corresponds to the 15-bit-representation in which the lower 4 bits of the analog value are overwritten with diagnostic data.

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 0,001) V				
≥ 11,008 V	overflow		11008	2B0×
≤ 10.992 V			10992	2AF×
10.512 V		at ↑ DIA Measured value out of range ON	10512	291×
≥ 10.496 V	over-steering		10496	290×
≤ 10.256 V		at ↓ DIA Measured value out of range OFF	10256	281×
10.016 V			10016	272×
10.000 V	nominal range		10000	271×
…				
4.992 V			4992	138×
…			…	…
0.016 V			16	001×
0.0000 V			0	000×
-0.016 V			-16	FFF×
…			…	…
-4.992 V			-4992	EC8×
…			…	…
-10.000 V			-10000	D8F×
- 10,016 V	under-steering		-10016	D8E×
-10.256 V		at ↑ DIA Measured value out of range OFF	-10256	D7F×
-10.496 V			-10496	D70×
-10.512 V	underflow	at ↓ DIA Measured value out of range ON	-10512	D6F×
-10.992 V			-10992	D51×
≤ -11.008 V			-11008	D50×

0 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 0,001) V				
≥ 11,008 V	overflow		11008	2B0×
≤ 10.992 V			10992	2AF×
10.512 V		at ↑ DIA Measured value out of range ON	10512	291×
≥ 10.496 V	over-steering		10496	290×
≤ 10.256 V		at ↓ DIA Measured value out of range OFF	10256	281×
10.016 V			10016	272×
10.000 V	nominal range		10000	271×
...				
4.992 V			4992	138×
...			...	...
0.016 V			16	001×
≤ 0.0000 V			0	000×
≥ -0.05 V	underflow	at ↑ DIA Measured value out of range OFF	0	000×
< -0,1 V		at ↓ DIA Measured value out of range ON	0	000×

0 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value/16 × 0,001) mA				
≥ 22,000 mA	overflow	at ↑ DIA Overflow/underflow ON	22000	55F×
≤ 21.984 mA		at ↓ DIA Overflow/underflow OFF	21984	55E×
21.024 mA			21024	522×
≥ 21.008 mA	over-steering	at ↑ DIA Measured value out of range ON	21008	521×
≤ 20.496 mA		at ↓ DIA Measured value out of range OFF	20496	501×
20.016 mA			20016	4E3×
20,000 mA	nominal range		20000	4E2×
...			...	...
10.000 mA			10000	271×
...			...	...
0.016 mA			16	001×
0.0000 mA			0	000×

4 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value/16 × 0,001) mA				
≥ 22,000 mA	overflow	at ↑ DIA Overflow/under-flow ON	22000	55F×
≤ 21.984 mA		at ↓ DIA Overflow/under-flow OFF	21984	55E×
≥ 21.008 mA	over-steering	at ↑ DIA Measured value out of range ON	21008	521×
≤ 20.992 mA			20496	5010
≤ 20.496 mA		at ↓ DIA Measured value out of range OFF		
20.016 mA			20016	4E3×
20,000 mA	nominal range		20000	4E2×
…			…	…
12.000 mA			12000	2EE×
…			…	…
4.016 mA			4016	0FB×
4.000 mA			4000	0FA×
3.984 mA	under-steering		3984	0F9×
≥ 3.792 mA		at ↑ DIA Measured value out of range OFF	3792	0ED×
< 3,600 mA		at ↓ DIA Measured value out of range ON	3600	0E1×
3.584 mA	underflow		3584	0E0×
≥ 2,001 mA		at ↑ DIA Wire break OFF	2001	07D×
< 2,000 mA		at ↓ DIA Wire break ON	2000	07D×
0.000 mA			0000	000×

6.6.6 Base modules/pin assignment

- BL67-B-4M12

Figure 6-21: BL67-B-4M12

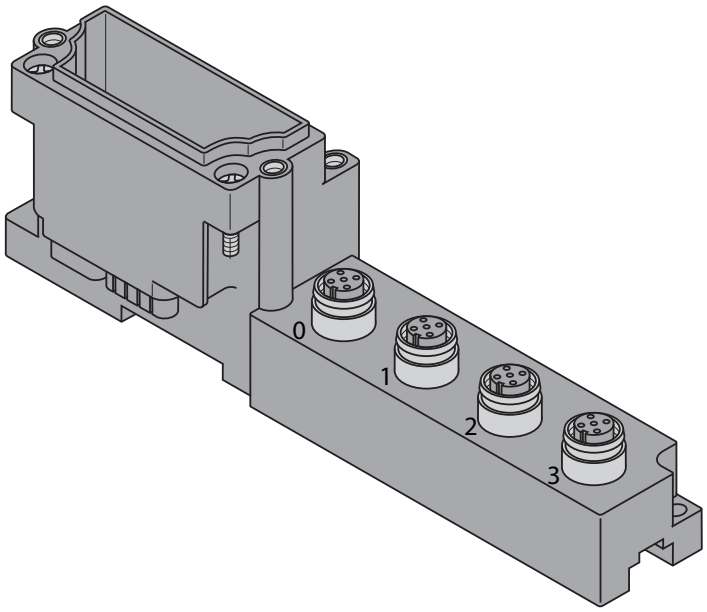
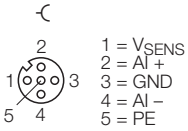


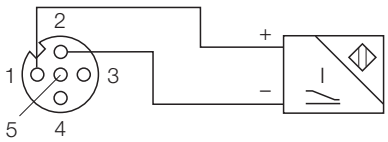
Table 6-34: Pin assignment BL67-4AI-V/I with BL67-B-4M12



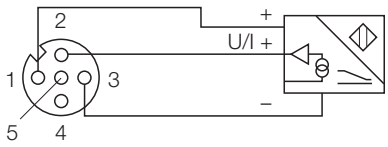
1 = V_{SENS}
2 = AI +
3 = GND
4 = AI –
5 = PE

Figure 6-22: Wiring diagrams BL67-4AI-V/I

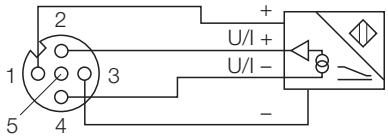
2-wire sensor with sensor supply via base module:



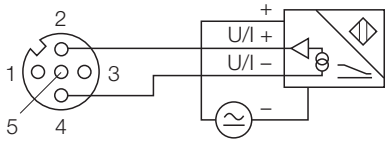
3-wire sensor with sensor supply via base module:



4-wire sensor with sensor supply via base module:



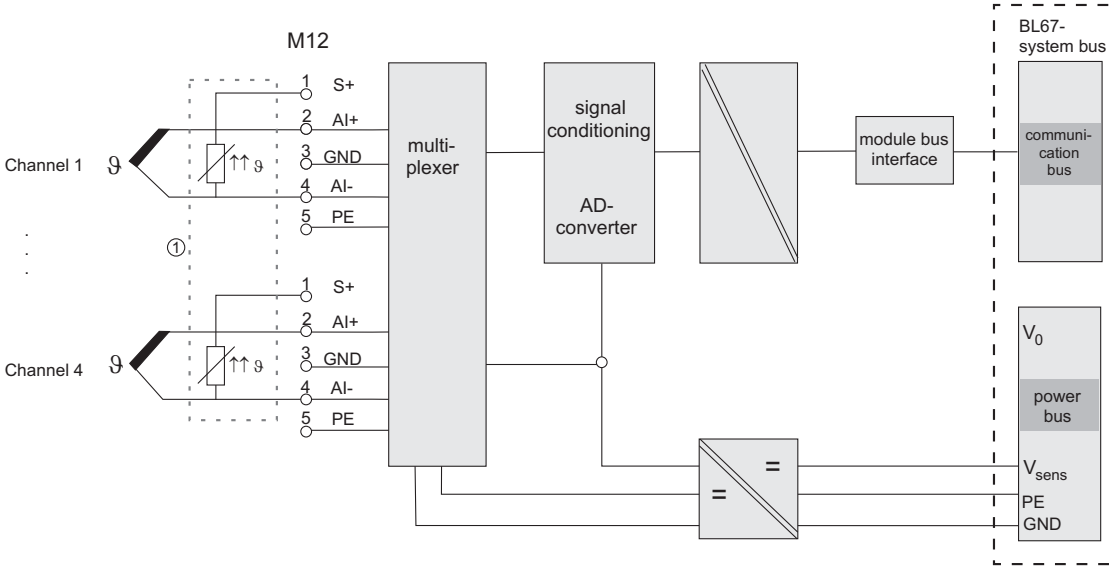
4-wire sensor with external sensor supply:



6.7 BL67-4AI-TC, thermo element

Figure 6-23:
BL67-4AI-TC

Figure 6-24:
Block diagram



① cold junction compensation r esistance (Pt1000) in male connector

6.7.1 Technical data

Table 6-35: Technical data

Designation	BL67-4AI-TC
Number of channels	4
Nominal voltage from supply terminal U_L	24 V DC
Nominal current from supply terminal I_L	< 30 mA
Nominal current from module bus I_{MB}	≤ 50 mA
Power loss of the module, typical	< 1 W
Input resistance	> 7 MΩ
Potential isolation	electronic to field
Sensors	according to IEC 584, class 1, 2, 3
Temperature ranges	
Type B	100 to 1820 °C
Type C	0 to 2315 (15 bit + sign) 0 to 2047 (12 bit)
Type E	-270 to 1000 °C
Type G	0 to 2315 (15 bit + sign) 0 to 2047 (12 bit)
Type J	-210 to 1200 °C
Type K	-270 to 1370 °C
Type N	-270 to 1300 °C
Type R	-50 to 1760 °C
Type S	-50 to 1760 °C
Type T	-270 to 400 °C
Voltage measurement (resolution)	
± 50 mV	< 2 µV
± 100 mV	< 4 µV
± 500 mV	< 20 µV
± 1 V	< 50 µV
Measurement value representation	16 bit signed integer/ 12 bit full range, left-justified
Basic error (nominal range at 23 °C)	see table page 6-69
Limit frequency analog	70 Hz
Repeat accuracy	0,5 % from end value
Temperature coefficient	≤ 150 ppm/°C from end value

Basic errors and repeat accuracies

Table 6-36: Basic error - nominal ranges **A**

Thermo couple	Nominal range for Basic error at 23 °C/73.4 °F 0,2 % from end value	Repeat accuracy/% % of positive end value
Type B	750 … 1820 °C	0.05
Type C	0 … 2315 °C (15 bit + sign) 0 … 2047 °C (12 bit)	0.05
Type G	0 … 2315 °C (15 bit + sign) 0 … 2047 °C (12 bit)	0.05
Type E	-200 … 1000 °C	0.05
Type J	-210 … 1200 °C	0.05
Type K	-200 … 1370 °C	0.05
Type N	-200 … 1300 °C	0.05
Type R	75 … 1760 °C	0.05
Type S	75 … 1760 °C	0.05
Type T	-200 … 400 °C	0.05
Voltage measurement	all measurement ranges	0.05

A For temperatures outside the defined measurement range, higher deviations for basic error and repeat accuracy are possible.

6.7.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	AI0 LSB							
	n + 1	AI0 MSB							
	n + 2	AI1 LSB							
	n + 3	AI1 MSB							
	n + 4	AI2 LSB							
	n + 5	AI2 MSB							
	n + 6	AI3 LSB							
	n + 7	AI3 MSB							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 6-37: Process data bits

Process data	Meaning
AI1 LSB	low byte of the analog value
AIx MSB	high byte of the analog value

6.7.3 Diagnostic and status messages

LED status displays

Table 6-38: LED displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending Diagnostics	Check the cause for the diagnosis
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. Check the supply of the module bus.
	OFF	No error messages or diagnostics	–
0 to 3	Green	Channel activated, normal operation	–
	Green flashing, 0.5 Hz	Channel diagnostics pending	Check the cause for the diagnosis
	OFF	Channel deactivated	–

Diagnostic data

This module has the following diagnostic data **per channel**:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Hardware failure	x	x	x	Common Mode voltage out of range	Cold junction compensation wire break	Thermocouple wire break	Measured value out of range

- Measured value out of range
  Indicates an exceed or undercut of the value ranges.
  The permissible measurement value limits are exceeded, it is thus possible that no valid measurement value can be detected.
- Thermocouple wire break
  Displays a wire break in the signal line.
- Cold junction compensation wire break
  The Pt1000-sensor for the respective channel in the base module is defective.
  → the Pt1000-sensor of the other channel is taken as cold junction.
  → A cold junction temperature of 23 °C is presumed.
- Common Mode voltage out of range
  The difference in potential between the measuring voltages is too high.
  The potential difference of the measuring voltages of a group of sensors is monitored: channel 0/1 resp. channel 2/3.
  Remedy:
  - Check the insulation of the sensors.
  - Check the difference in potential between non-insulated sensors
  - If the sensors are not insulated, use channels of different sensor groups (e.g. channel 1 and channel 3).
- Hardware failure
  Shows common errors of the module hardware.
  The return analog value in case of an error is "0".

6.7.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	reserved
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	Deactivate diagnostics
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	Thermocouple type
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
Channel 1	Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	reserved
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	Deactivate diagnostics
		Bit 3		Bit 11		Bit 3	Deactivate channel
		Bit 4		Bit 12		Bit 4	Thermocouple type
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
Channel 2	Byte 2	Bit 0	Word 1	Bit 0	Byte 2	Bit 0	reserved
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	Deactivate diagnostics
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	Thermocouple type
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
Channel 3	Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	reserved
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	Deactivate diagnostics
		Bit 3		Bit 11		Bit 3	Deactivate channel
		Bit 4		Bit 12		Bit 4	Thermocouple type
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

Table 6-39: Module parameters

A *default setting*

Parameter name	Value
Data format	0 = 15 bit + sign **A**
	1 = 12 bit (left-justified)
Deactivate diagnostics	0 =no **A**
	1 = yes
Deactivate channel	0 =no **A**
	1 = yes
Thermocouple type	0000 = Type K, -270 … 1370 °C**A** 0001 = Type B, 100 … 1820 °C 0010 = Type E, -270 … 1000 °C 0011 = Type J, -210 … 1200 °C 0100 = Type N, -270 … 1300 °C 0101 = Type R, -50 … 1760 °C 0110 = Type S, -50 … 1760 °C 0111 = Type T, -270 … 400 °C 1000 = +/-50 mV 1001 = +/-100 mV 1010 = +/-500 mV 1011 = +/-1000 mV 1100 = Type K, -454 … 2498 °F 1101 = Type K, -454 … 2498 °F 1110 = Type C 0 … 2315 °C 1111 = Type G 0 … 2315 °C

6.7.5 Base modules/pin assignment

- BL67-B-

Figure 6-25: BL67-B-4M12

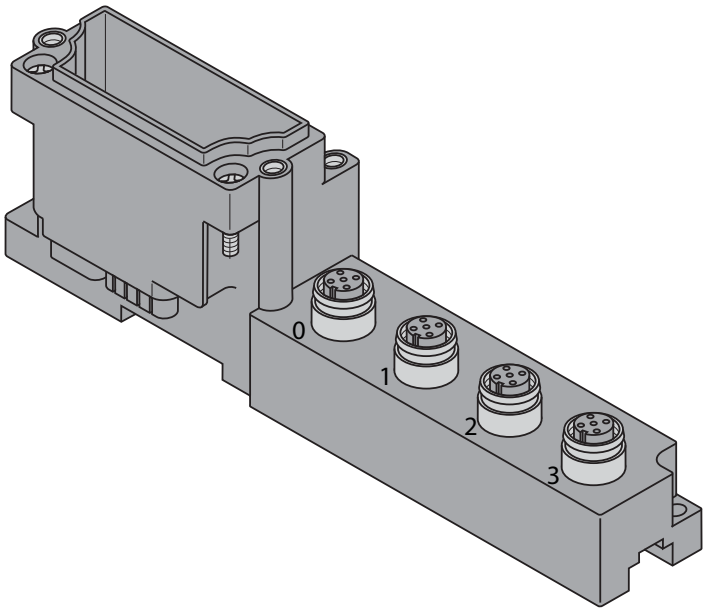
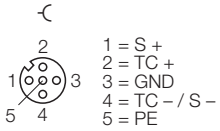
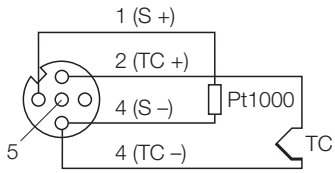


Table 6-40: Pin assignment BL67-2AI-TC



S = PT1000 sensor for cold junction compensation
TC = thermo couple

Table 6-41: Wiring diagram BL67-4AI-TC



Suitable connector with a Pt1000 for the cold-junction compensation:
BL67-WAS5-THERMO

6.7.6 Measurement value representation

Temperature measurement

- 16-bit-representation
  The measured temperature is multiplied by 10.
  Example:
  10,1 °C → 101 → 0x0065
- 12-bit-representation
  Value representation depends on the measuring unit (°C or °F).
  Celsius:
  The measured temperature is shifted 4 bit to the left.
  Example (°C): 10,1 °C → 10 → (0x000A <<4) → 0x00A0
  Fahrenheit:
  The measured temperature is divided by 2 shifted 4 bit to the left.
  Example (°F): 10,1 °C → 5 → (0x0005 << 4) → 0x0050

Example of a value representation (thermocouple Type K)

Measurement [°C]	0 = 15 bit + sign		12 Bit [°C]		12 Bit (°F)	
	dec.	hex.	dec.	hex.	dec.	hex.
-270	-2700	F574	-4320	EF20	-2160	F790
-269.9	-2699	F575	-4320	EF30	-2144	F7A0
-269	-2690	F57E	-4304	EF30	-2144	F7A0
-200	-2000	F830	-3200	F380	-1600	F9C0
-100	-1000	FC18	-1600	F9C0	-800	FCE0
-50	-500	FE0C	-800	FCE0	-400	FE70
-1	-10	FFF6	-16	FFF0	0	0000
0.1	-1	FFFF	0	0000	0	0000
0	0	0000	0	0000	0	0000
0.1	1	0001	0	0000	0	0000
1	10	000A	16	0010	0	0000
500	5000	1388	8000	1F40	4000	0FA0
1000	10000	2710	16000	3E80	8000	1F40
1500	15000	3A98	24000	5DC0	12000	2EE0
1819	18190	470E	29104	71B0	14544	38D0
1819.9	18199	4717	29104	71B0	14544	38D0
1820	18200	4718	29120	71C0	14560	38E0

NOTE

In 12 bit representation, the module's diagnostic data are mapped into bit 0 - 3 of the input data.

Voltage measurement

Measurement [mV]				0 = 15 bit + sign		12 bit	
50	100	500	1000	dec.	hex.	dec.	hex.
-50	-100	-500	-1000	-31768	8000	-32768	8000
-49.998	-99.997	-499.985	-999.969	-32767	8001	-32767	8001
-49.976	-99.951	-499.756	-999.512	-32752	8010	-32752	8010
-0.024	-0.049	-0.244	-0.488	-16	FFF0	-16	FFF0
-0.002	-0.003	-0.015	-0.031	-1	FFFF	0	0000
0	0	0	0	0	0000	0	0000
0.002	0.003	0.015	0.031	1	0001	0	0000
0.024	0.049	0.244	0.488	16	0010	16	0010
49.951	99.902	499.512	999.023	32736	7FE0	32736	7FE0
49.997	99.994	499.969	999.939	32766	7FFE	32752	7FF0
49.998	99.997	499.985	999.969	32767	7FFF	32752	7FF0

NOTE

In 12 bit representation, the module's diagnostic data are mapped into bit 0 - 3 of the input data.

7 Digital output modules

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7.1 Overview

Digital output modules (DO) receive output values from the gateway via the internal module bus. The modules convert these values and transmit the corresponding high or low level signals for each channel to the field level via the base modules.

The outputs are rated according to EN 61131-2 type 2.

The sensor supply (V_O) is tapped from the internal voltage supply bus.
The sensor voltage V_{sens} is supplied by the gateway or a Power Feeding module.

The module bus electronics of the digital output modules are galvanically isolated from the field level via an opto-coupler.

WARNING!

Automatic recovery of outputs
Active outputs
➤ Deactivate the automatic recovery of outputs via the respective parameterization

WARNING!

Faulty safety-related switching-off
Active outputs
➤ Switch-off digital outputs all-pole in galvanically isolated groups

LED displays

Channel statuses are indicated by LEDs. Error signals from the I/O level are indicated by each module via the "D" LED. The corresponding diagnostic information is transmitted to the gateway via diagnostic bits.

ATTENTION!

High voltage when switching-off inductive loads
Destruction of the electronic in the module
➤ Provide an external suppressor.

7.1.1 Module overview

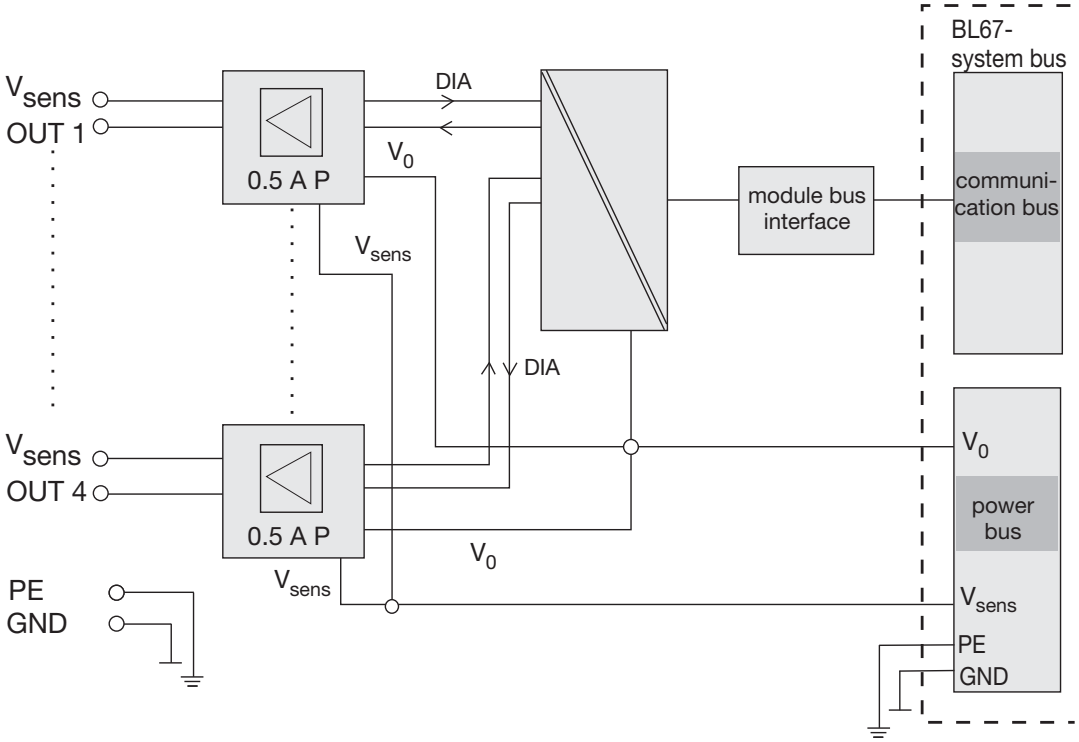
Table 7-1: Module overview

Module	No. of channels	Output current, nominal value
BL67-4DO-0.5A-P	4	0.5 A
BL67-4DO-2A-P	4	2 A
BL67-4DO-4A-P	4	4 A
BL67-8DO-0.5A-P	8	0.5 A
BL67-16DO-0.1A-P	16	0.1 A
BL67-4DO-2A-N	4	2 A
BL67-8DO-0.5A-N	8	0.5 A
Module	**Isolation**	**Positive switching**
BL67-4DO-0.5A-P	✓	✓
BL67-4DO-2A-P	✓	✓
BL67-4DO-4A-P	✓	✓
BL67-8DO-0.5A-P	✓	✓
BL67-16DO-0.1A-P	✓	✓
BL67-4DO-2A-N	✓	-
BL67-8DO-0.5A-N	✓	-

7.2 BL67-4DO-0.5A-P

Figure 7-1:
BL67-4DO-0.5A

Figure 7-2:
Block diagram



7.2.1 Technical data

Table 7-2: Technical data

Designation	BL67-4DO-0.5A-P
No. of channels	4
Nominal voltage from supply terminal	24 VDC
Load voltage V_O	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	< 100 mA (if load current = 0)
Power loss of the module, typical	< 1,5 W
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
High level $_A$ (nominal value)	0.5 A
High level I_{AMAX}	0.6 A (according to IEC 6 1131-2)
Simultaneity factor	100 %
Switch-off characteristic K_A	
I_{OUT} > 1.5 A	< 4 ms
1.0 A < I_{OUT} < 1.5 A	< 10 s
0.6 A < I_{OUT} < 1.0 A	min. 10 s/max. 60 s
Delay at signal change and resistive load	
from low to high level	3 ms
from high to low level	3 ms
Load impedance range	48 Ω to 1 kΩ
Switch-on resistance R_{on}	max. 190 mΩ
Resistive, inductive and lamp loads can be connected	
Load impedance, resistive R_{LO}	48 Ω
Lamp load R_{LL}	3 W
Switching frequency	
resistive load	200 Hz
inductive load	2 Hz
lamp load	20 Hz
Isolation voltage	

U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit proof	yes, according to EN 61 131-2

NOTE

The parallel switching of outputs is possible with the synchronous switching of the channels. In this case, the maximum output current can be increased up to 2 A, depending on the number of the parallel switched outputs.

7.2.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	-	-	-	-	DO3	DO2	DO1	DO0

m = Offset of output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 7-3: Process data bits

Process data	Value	Meaning
DOx	0	Digital output inactive
	1	Digital output active

7.2.3 Diagnostic and status messages

LED status displays

Table 7-4: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	-
0 to 3	Green	Status of channel x = "1"	-
	Red	Short circuit/overload at channel x Overload at channel x	Eliminate the cause for the short-circuit or the overload. → After cooling the module switches on automatically.
	OFF	Status of channel x = "0"	-

Diagnostic data

This module has the following diagnostic data per channel:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	Overcurrent K3	Overcurrent K2	Overcurrent K1	Overcurrent K0

Table 7-5: Diagnostics

Diagnostics	
Overcurrent	Overcurrent or short-circuit at the output. The channel is switched off automatically. For the for switching-off characteristics of the outputs see Technical data Table 7-2.

7.2.4 Module parameters

none

7.2.5 Base modules/pin assignment

- BL67-B-4M8

Figure 7-3: BL67-B-4M8

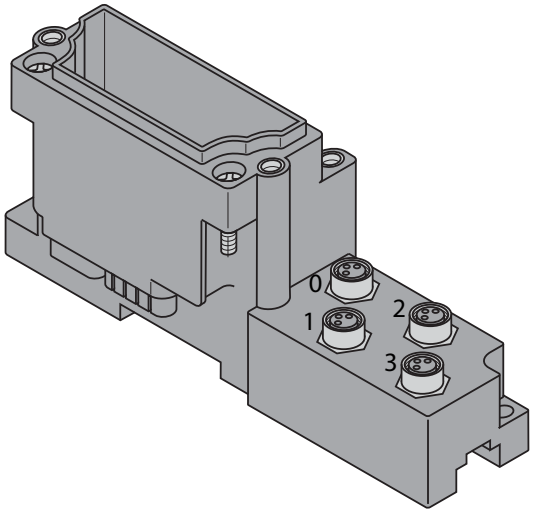


Figure 7-4: Pin assignment BL67-4DO-0.5A-P with BL67-B-4M8

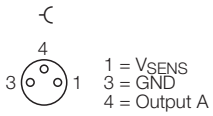
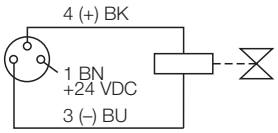


Figure 7-5: Wiring diagram BL67-4DO-0.5A-P with BL67-B-4M8



- BL67-B-2M12/BL67-B-2M12-P (paired)

Figure 7-6: BL67-B-2M12/ BL67-B-2M12-P

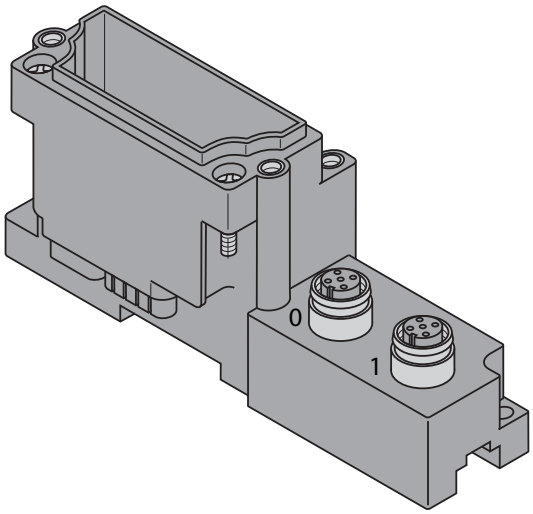


Figure 7-7:
Pin assignment
BL67-4DO-0.5A-P
with BL67-B-2M12/
BL67-B-2M12-P

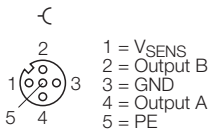
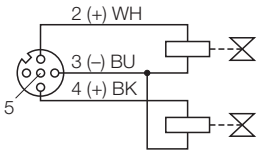


Figure 7-8:
Wiring diagram
BL67-4DO-0.5A-P
with
BL67-B-2M12/
BL67-B-2M12-P



- BL67-B-4M12

Figure 7-9:
BL67-B-4M12

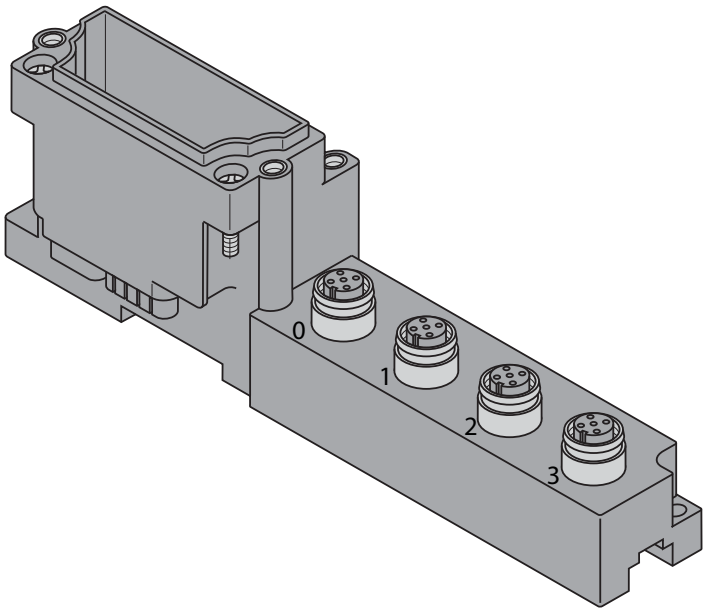


Figure 7-10:
Pin assignment
BL67-4DO-0.5A-P
with BL67-B-4M12

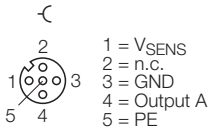
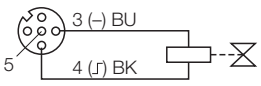


Figure 7-11:
Wiring diagram
BL67-4DO-0.5A-P
with BL67-B-4M12



- BL67-B-1M23

Figure 7-12:
BL67-B-1M23

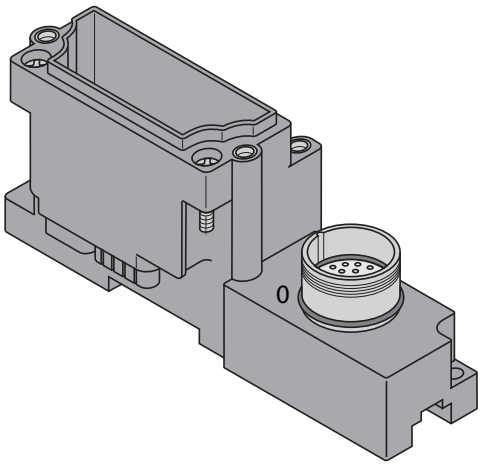


Figure 7-13:
Pin assignment
BL67-4DO-0.5A-P
with BL67-B-1M23

1 = Signal 0
2 = Signal 1
3 = Signal 2
4 = Signal 3
5 = n.c.
6 = n.c.
7 = n.c.
8 = n.c.
9 = V_{SENS}
10 = V_{SENS}
11 = V_{SENS}
12 = GND

7.2.6 Signal assignment

Table 7-6: Signal assignment with BL67-B-4M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 7-7: Signal assignment with BL67-B-2M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C1P2	C0P2	C1P4	C0P4

Table 7-8: Signal assignment with BL67-B-2M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C1P2	C1P4	C0P2	C0P4

Table 7-9: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 7-10: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C0P4	C0P3	C0P2	C0P1

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

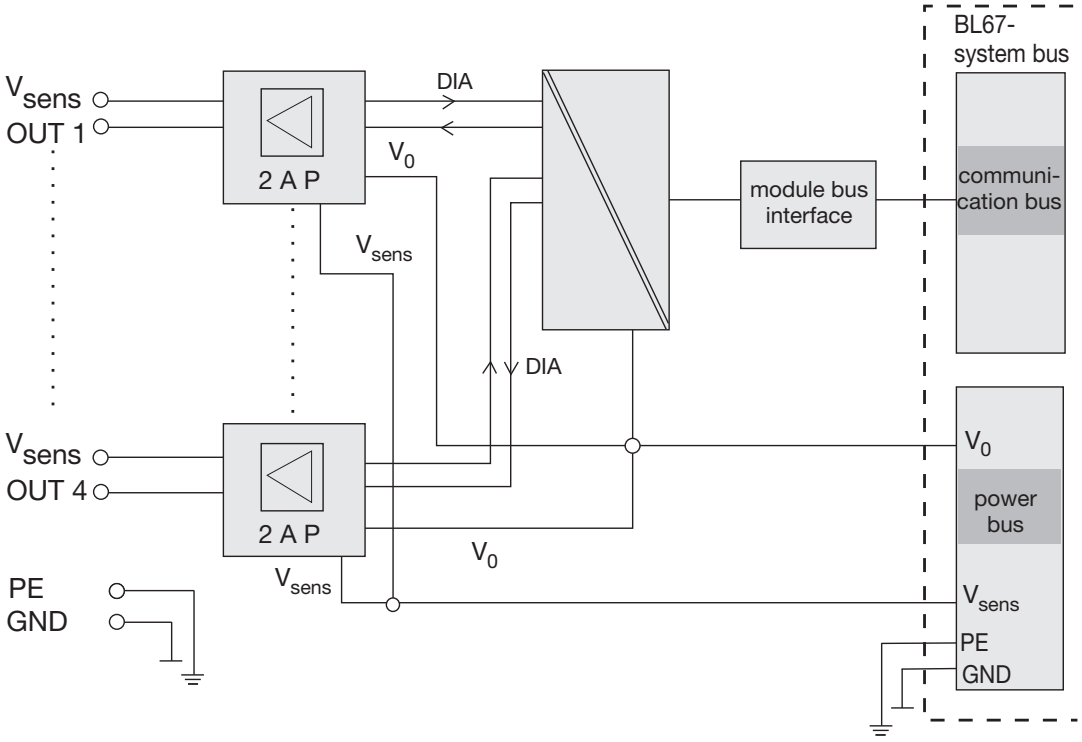
C = slot no.

P = pin no.

7.3 BL67-4DO-2A-P

Figure 7-14:
BL67-4DO-2A-P

Figure 7-15:
Block diagram



7.3.1 Technical data

Table 7-11: Technical data

Designation	BL67-4DO-2A-P
No. of channels	4
Nominal voltage from supply terminal	24 VDC
Load voltage V_O	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	< 100 mA (load current= 0)
Power loss of the module, typical	< 1,5 W
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
High level $_A$ (nominal value)	2 A
High level I_{AMAX}	max. 2.4 A (according to IEC 61131-2)
Simultaneity factor	100 %
Switch-off characteristic K_A	
I_{OUT} > 6 A	< 4 ms
4 A < I_{OUT} < 6 A	< 10 s
2.2 A < I_{OUT} < 4 A	min. 10 s/max. 60 s
Delay at signal change and resistive load	
from low to high level	3 ms
from high to low level	3 ms
Load impedance range	12 Ω to 1 kΩ
Switch-on resistance R_{on}	max. 50 mΩ
Resistive, inductive and lamp loads can be connected	
Load impedance, resistive R_{LO}	12 Ω
Lamp load R_{LL}	10 W
Switching frequency	
resistive load	200 Hz
inductive load	2 Hz
lamp load	20 Hz

Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit proof	yes, according to EN 61 131-2

NOTE

The parallel switching of outputs is possible with the synchronous switching of the channels. In this case, the maximum output current can be increased up to 8 A, depending on the number of the parallel switched outputs.

7.3.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	-	-	-	-	DO3	DO2	DO1	DO0

m = Offset of output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 7-12: Process data bits

Process data	Value	Meaning
DOx	0	Digital output inactive
	1	Digital output active

7.3.3 Diagnostic and status messages

LED status displays

Table 7-13: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	-
0 to 3	Green	Status of channel x = "1"	-
	Red	Short circuit/overload at channel x Overload at channel x	Eliminate the cause for the short-circuit or the overload. → After cooling the module switches on automatically.
	OFF	Status of channel x = "0"	-

Diagnostic data

This module has the following diagnostic data per channel:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	Overcurrent K3	Overcurrent K2	Overcurrent K1	Overcurrent K0

Table 7-14: Diagnostics

Diagnostics	
Overcurrent	Overcurrent or short-circuit at the output. The channel is switched off automatically. For the for switching-off characteristics of the outputs see Technical data Table 7-2.

7.3.4 Module parameters

none

7.3.5 Base modules/pin assignment

- BL67-B-4M8

Figure 7-16: BL67-B-4M8

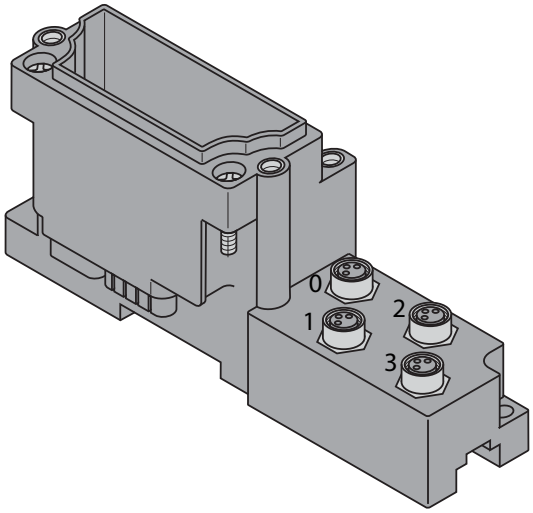


Figure 7-17: Pin assignment BL67-4DO-2A-P with BL67-B-4M8

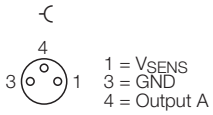
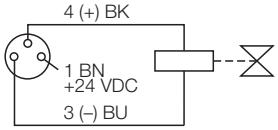


Figure 7-18: Wiring diagram BL67-4DO-2A-P with BL67-B-4M8



- BL67-B-2M12/BL67-B-2M12-P (paired)

Figure 7-19: BL67-B-2M12/ BL67-B-2M12-P

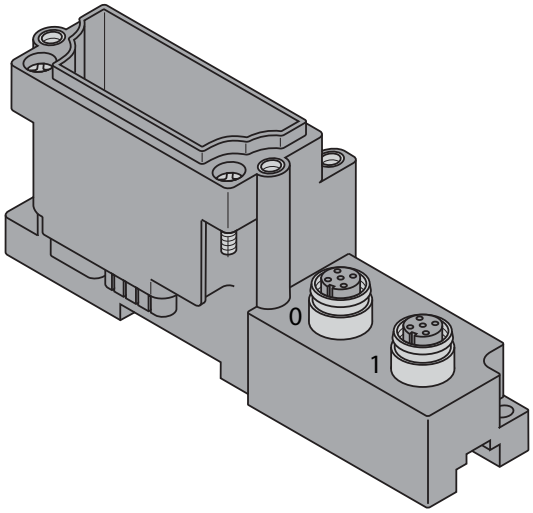


Figure 7-20:
Pin assignment
BL67-4DO-2A-P
with BL67-B-2M12/
BL67-B-2M12-P

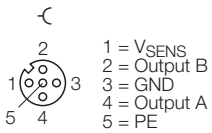
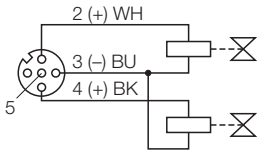


Figure 7-21:
Wiring diagram
BL67-4DO-2A-P
with BL67-B-2M12/
BL67-B-2M12-P



- BL67-B-4M12

Figure 7-22:
BL67-B-4M12

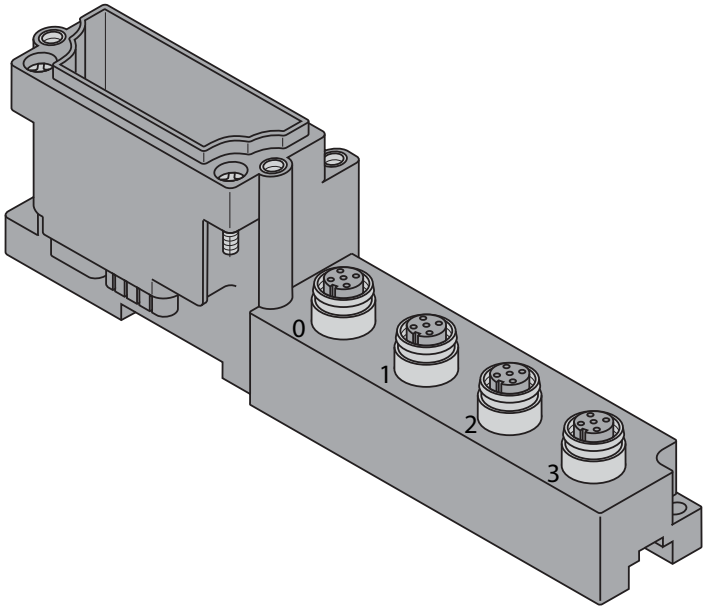


Figure 7-23:
Pin assignment
BL67-4DO-2A-P
with BL67-B-4M12

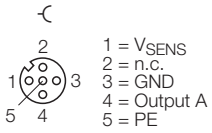
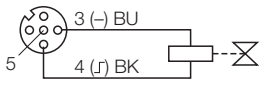


Figure 7-24:
Wiring diagram
BL67-4DO-2A-P
with BL67-B-4M12



- BL67-B-1M23

Figure 7-25:
BL67-B-1M23

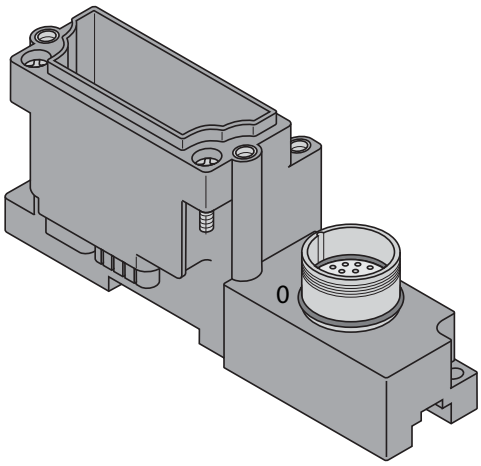
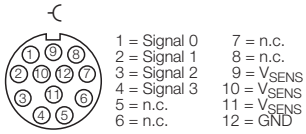


Figure 7-26:
Pin assignment
BL67-4DO-2A-P
with BL67-B-1M23



7.3.6 Signal assignment

Table 7-15: Signal assignment with BL67-B-4M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 7-16: Signal assignment with BL67-B-2M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C1P2	C0P2	C1P4	C0P4

Table 7-17: Signal assignment with BL67-B-2M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C1P2	C1P4	C0P2	C0P4

Table 7-18: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 7-19: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C0P4	C0P3	C0P2	C0P1

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

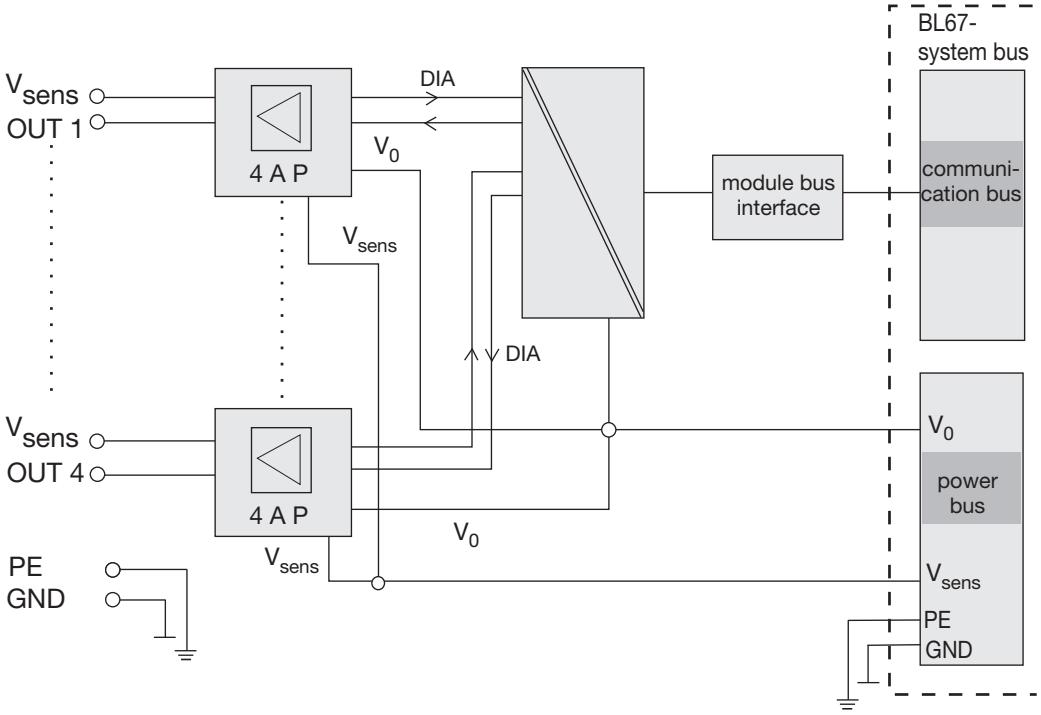
C = slot no.

P = pin no.

7.4 BL67-4DO-4A-P

Figure 7-27:
BL67-4DO-4A-P

Figure 7-28:
Block diagram



7.4.1 Technical data

Table 7-20: Technical data

Designation	BL67-4DO-4A-P
No. of channels	4
Nominal voltage from supply terminal	24 VDC
Load voltage V_O	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	< 100 mA (if load current = 0)
Power loss of the module, typical	< 1,5 W
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
High level $_A$ (nominal value)	4 A
High level I_{AMAX}	max. 4.8 A (according to IEC 61131-2)
Simultaneity factor	at 3 A = 50 % at 4 A = 25 %
Switch-off characteristic K_A	
I_{OUT} > 12 A	< 8 ms
8 A < I_{OUT} < 12 A	< 10 s
4.4 A < I_{OUT} < 8 A	min. 10 s/max. 60 s
Delay at signal change and resistive load	
from low to high level	3 ms
from high to low level	3 ms
Load impedance range	6 Ω to 1 kΩ
Switch-on resistance R_{on}	max. 50 mΩ
Resistive, inductive and lamp loads can be connected	
Load impedance, resistive R_{LO}	6 Ω
Lamp load R_{LL}	10 W
Switching frequency	
resistive load	200 Hz
inductive load	2 Hz
lamp load	20 Hz

Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit protection	yes, according to EN 61 131-2

NOTE

The parallel switching of outputs is possible with the synchronous switching of the channels. In this case, the maximum output current can be increased up to 10 A, depending on the number of the parallel switched outputs.

7.4.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	-	-	-	-	DO3	DO2	DO1	DO0

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 7-21: Process data bits

Process data	Value	Meaning
DOx	0	Digital output inactive
	1	Digital output active

7.4.3 Diagnostic and status messages

LED status displays

Table 7-22: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	-
0 to 3	Green	Status of channel x = "1"	-
	Red	Short circuit/overload at channel x Overload at channel x	Eliminate the cause for the short-circuit or the overload. After cooling the module switches on automatically.
	OFF	Status of channel x = "0"	-

Diagnostic data

This module has the following diagnostic data per channel:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	Overcurrent K3	Overcurrent K2	Overcurrent K1	Overcurrent K0

Table 7-23: Diagnostics

Diagnostics	
Overcurrent	Overcurrent or short-circuit at the output. The channel is switched off automatically. For the for switching-off characteristics of the outputs see Technical data Table 7-2.

7.4.4 Module parameters

none

7.4.5 Base modules/pin assignment

- BL67-B-4M8

Figure 7-29: BL67-B-4M8

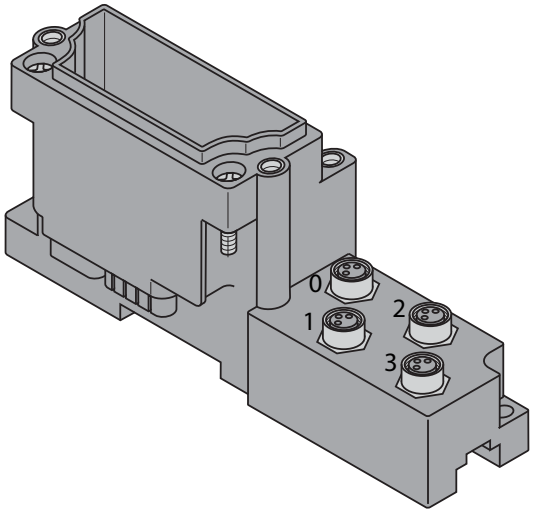


Figure 7-30: Pin assignment BL67-4DO-4A-P with BL67-B-4M8

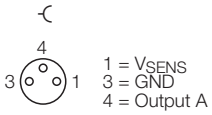
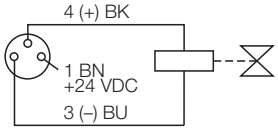


Figure 7-31: Wiring diagram BL67-4DO-4A-P with BL67-B-4M8



- BL67-B-2M12/BL67-B-2M12-P (paired)

Figure 7-32: BL67-B-2M12/ BL67-B-2M12-P

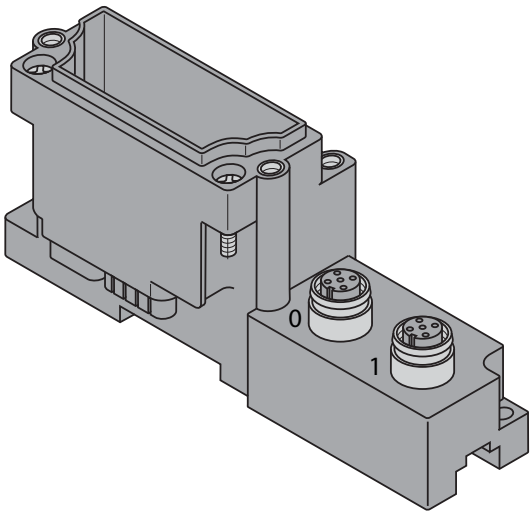


Figure 7-33: Pin assignment BL67-4DO-4A-P with BL67-B-2M12/ BL67-B-2M12-P

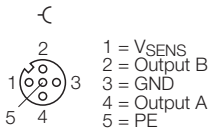
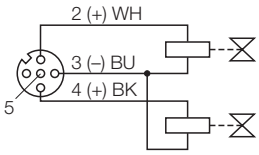


Figure 7-34: Wiring diagram BL67-4DO-4A-P with BL67-B-2M12/ BL67-B-2M12-P



- BL67-B-4M12

Figure 7-35: BL67-B-4M12

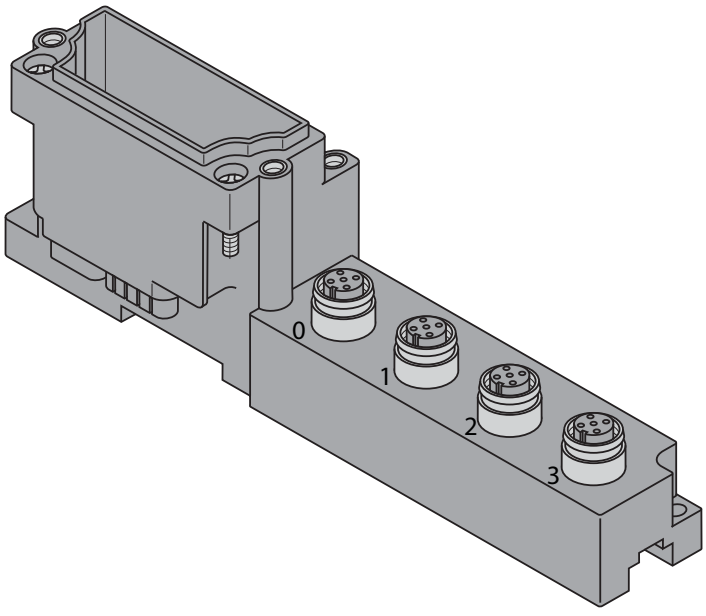


Figure 7-36:
Pin assignment
BL67-4DO-4A-P
with BL67-B-4M12

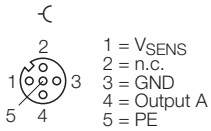
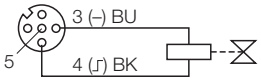


Figure 7-37:
Wiring diagram
BL67-4DO-4A-P
with BL67-B-4M12



- BL67-B-1M23

Figure 7-38:
BL67-B-1M23

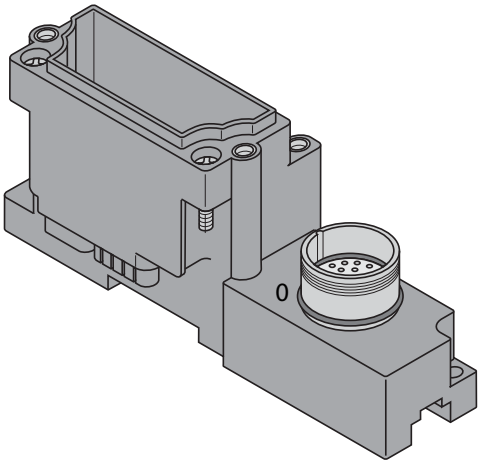


Figure 7-39:
Pin assignment
BL67-4DO-4A-P
with BL67-B-1M23

1 = Signal 0
2 = Signal 1
3 = Signal 2
4 = Signal 3
5 = n.c.
6 = n.c.
7 = n.c.
8 = n.c.
9 = V_{SENS}
10 = V_{SENS}
11 = V_{SENS}
12 = GND

7.4.6 Signal assignment

Table 7-24: Signal assignment with BL67-B-4M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 7-25: Signal assignment with BL67-B-2M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C1P2	C0P2	C1P4	C0P4

Table 7-26: Signal assignment with BL67-B-2M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C1P2	C1P4	C0P2	C0P4

Table 7-27: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 7-28: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C0P4	C0P3	C0P2	C0P1

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

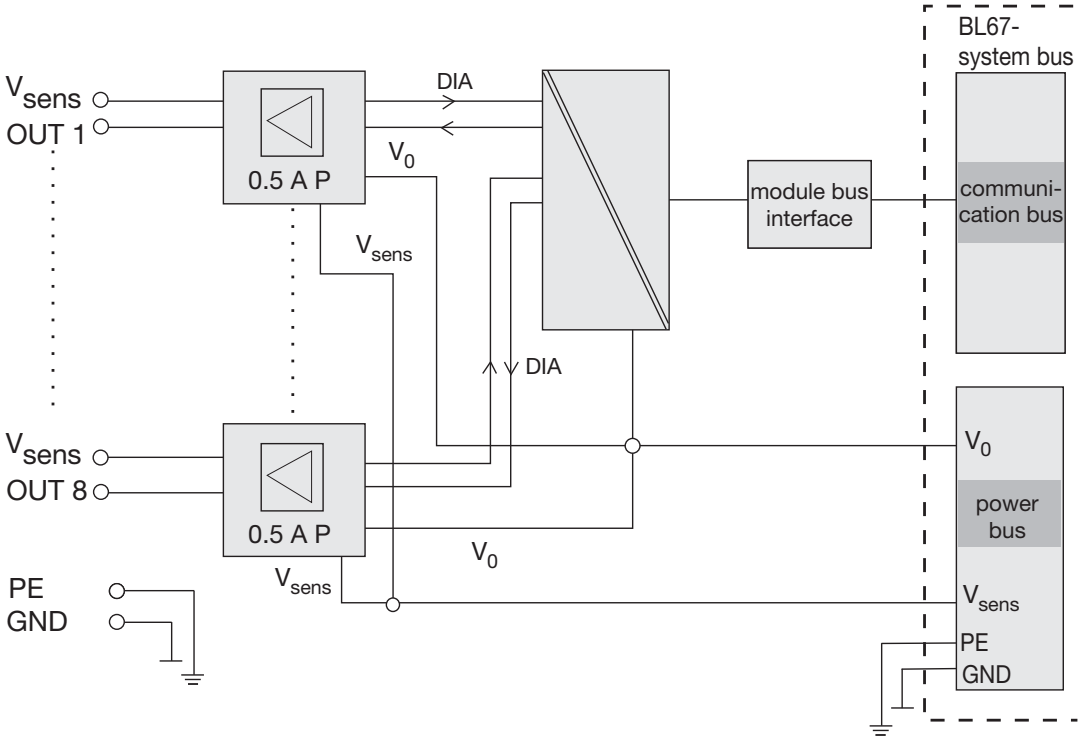
C = slot no.

P = pin no.

7.5 BL67-8DO-0.5A-P

Figure 7-40:
BL67-8DO-0.5A-P

Figure 7-41:
Block diagram



7.5.1 Technical data

Table 7-29: Technical data

Designation	BL67-8DO-0.5A-P
No. of channels	8
Nominal voltage from supply terminal	24 VDC
Load voltage V_O	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption at 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	< 100 mA (if load current = 0)
Power loss of the module, typical	< 1,5 W
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
High level $_A$ (nominal value)	0.5 A
High level I_{AMAX}	0.6 A (according to IEC 61131-2)
Simultaneity factor	100 %
Switch-off characteristic K_A	
I_{OUT} > 1.5 A	< 4 ms
1.0 A < I_{OUT} < 1.5 A	10 s
0.6 A < I_{OUT} < 1.0 A	min. 10 s/max. 60 s
Delay at signal change and resistive load	
from low to high level	3 ms
from high to low level	3 ms
Load impedance range	48 Ω to 1 kΩ
Switch-on resistance R_{on}	max. 190 mΩ
Resistive, inductive and lamp loads can be connected	
Load impedance, resistive R_{LO}	48 Ω
Lamp load R_{LL}	3 W
Switching frequency	
resistive load	200 Hz
inductive load	2 Hz
lamp load	20 Hz

Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit proof	yes, according to EN 61 131-2

NOTE

The parallel switching of outputs is possible with the synchronous switching of the channels. In this case, the maximum output current can be increased up to 4 A, depending on the number of the parallel switched outputs.

7.5.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	DO7	DO6	DO5	DO4	DO3	DO2	DO1	DO0

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 7-30: Process data bits

Process data	Value	Meaning
DOx	0	Digital output inactive
	1	Digital output active

7.5.3 Diagnostic and status messages

LED status displays

Table 7-31: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	-
0 to 7	Green	Status of channel x = "1"	-
	Red	Short circuit/overload at channel x Overload at channel x	Eliminate the cause for the short-circuit or the overload. → After cooling the module switches on automatically.
	OFF	Status of channel x = "0"	-

Diagnostic data

This module has the following diagnostic data per channel:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Overcurrent Ch7	Overcurrent Ch6	Overcurrent Ch5	Overcurrent Ch4	Overcurrent Ch3	Overcurrent Ch2	Overcurrent Ch1	Overcurrent Ch0

Table 7-32: Diagnostics

Diagnostics	
Overcurrent	Overcurrent or short-circuit at the output. The channel is switched off automatically. For the for switching-off characteristics of the outputs see Technical data Table 7-2.

7.5.4 Module parameters

none

7.5.5 Base modules/pin assignment

- BL67-B-8M8

Figure 7-42: BL67-B-8M8

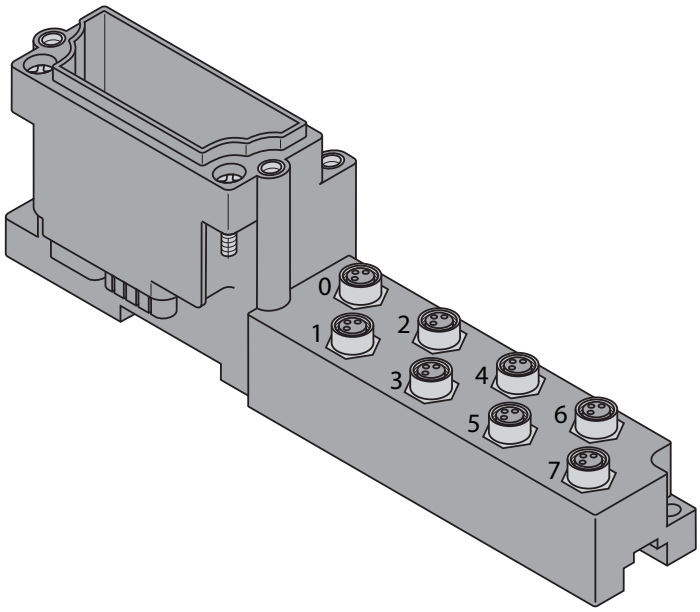


Figure 7-43: Pin assignment BL67-8DO-0.5A-P with BL67-B-8M8

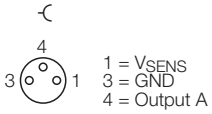
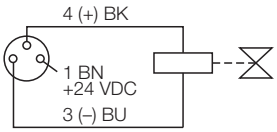


Figure 7-44: Wiring diagram BL67-8DO-0.5A-P with BL67-B-8M8



- BL67-B-4M12/BL67-B-4M12-P

Figure 7-45: BL67-B-4M12/ BL67-B-4M12-P

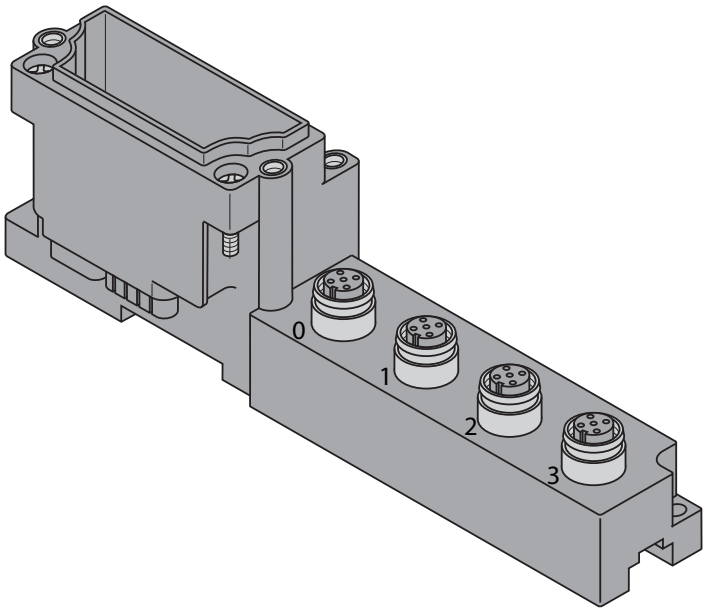


Figure 7-46: Pin assignment BL67-8DO-0.5A-P with BL67-B-4M12

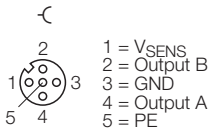
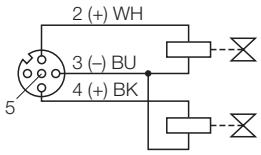


Figure 7-47: Wiring diagram BL67-8DO-0.5A-P with BL67-B-4M12



- BL67-B-1M23

Figure 7-48: BL67-B-1M23

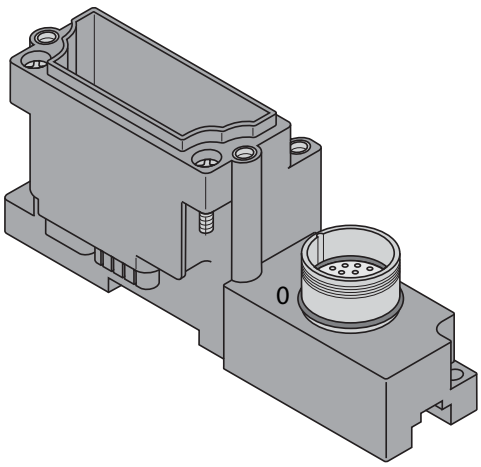


Figure 7-49: Pin assignment BL67-8DO-0.5A-P with BL67-B-1M23

7.5.6 Signal assignment

Table 7-33: Signal assignment with BL67-B-8M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4

Table 7-34: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C3P2	C2P2	C1P2	C0P2	C3P4	C2P4	C1P4	C0P4

Table 7-35: Signal assignment with BL67-B-4M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4

Table 7-36: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

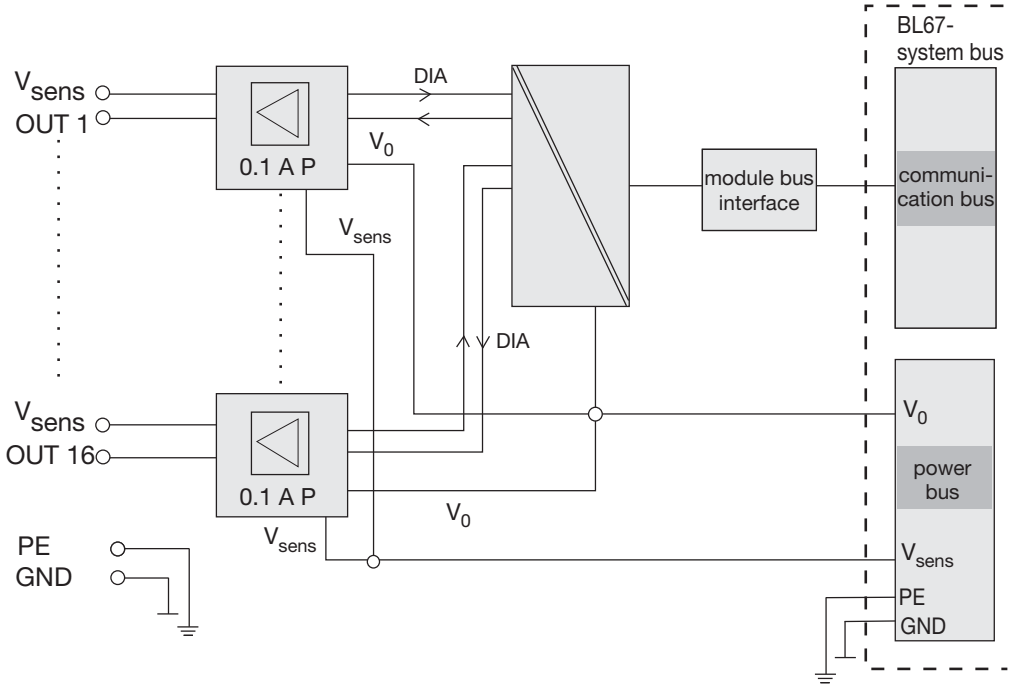
C = slot no.

P = pin no.

7.6 BL67-16DO-0.1A-P

Figure 7-50:
BL67-16DO-0.1A-P

Figure 7-51:
Block diagram



7.6.1 Technical data

Table 7-37: Technical data

Designation	BL67-16DO-0.1A-P
No. of channels	16
Nominal voltage from supply terminal	24 VDC
Load voltage V_O	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	< 100 mA (if load current = 0)
Power loss of the module, typical	< 1,5 W
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
High level $_A$ (nominal value)	0.1 A
High level I_{AMAX}	0.12 A (according to IEC 61131-2)
Simultaneity factor	100 % (at I_{MAX} ≤ 120 mA), 50 % (at I_{MAX} ≤ 180 mA)
Delay at signal change and resistive load	
from low to high level	3 ms
from high to low level	3 ms
Load impedance range	250 Ω to 10 kΩ
Switch-on resistance R_{on}	max. 2 Ω
Resistive, inductive and lamp loads can be connected	
Load impedance, resistive R_{LO}	250 Ω
Switching frequency	
resistive load	200 Hz
inductive load	2 Hz
Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit proof	yes, according to EN 61 131-2

7.6.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	DO7	DO6	DO5	DO4	DO3	DO2	DO1	DO0
	m	DO15	DO14	DO13	DO12	DO11	DO10	DO9	DO8

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 7-38: Process data bits

Process data	Value	Meaning
DOx	0	Digital output inactive
	1	Digital output active

7.6.3 Diagnostic and status messages

LED status displays

Table 7-39: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	-
0 to 7	Green	Status of channel x/y = "1" (see NOTE below)	-
	Red	Diagnostic at channel x/y	Eliminate the cause for the short circuit or the overload (see page 7-39 Diagnostic data) → After cooling the module switches on automatically.
	OFF	Status of channel x/y = "0" (see NOTE below)	-

NOTE

In this module, each channel LED indicates the status of two outputs:
LED 0 = status of channel 0/1
…
LED 7 = status of channel 14/15

The red LED, indicating a channel diagnosis, is dominant.

Diagnostic data

This module has the following diagnostic data per channel:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Overcurr. Ch7	Overcurr. Ch6	Overcurr. Ch5	Overcurr. Ch4	Overcurr. Ch3	Overcurr. Ch2	Overcurr. Ch1	Overcurr. Ch0
1	Overcurr. Ch15	Overcurr. Ch14	Overcurr. Ch13	Overcurr. Ch12	Overcurr. Ch11	Overcurr. Ch10	Overcurr. Ch9	Overcurr. Ch8

Diagnostics via software

Table 7-40: Diagnostics

Diagnostics	
Overcurrent	Short circuit and/or wire break (depending on the parameterization, see Table 7-41) – Byte 0, bit 0 to 7 = channel 0 to 7 – Byte 1, bit 0 to 7 = channel 8 to 15

7.6.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

Standard				**PROFIBUS PROFINET**		**Parameter**
byte-oriented		**word-oriented**				
Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Wire break detection threshold
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	Overcurrent detection threshold
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Activate wire break monitoring
	Bit 1		Bit 9		Bit 1	Activate overcurrent monitoring
	Bit 2		Bit 10		Bit 2	reserved
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	

Table 7-41: Module parameters

A *default setting*
B *Module firmware ≥ 6*

Parameter name	Value	Description
Threshold Wire break detection threshold	0000 = 0 mA **A** 0001 = 10 mA 0010 = 20 mA 0011 = 30 mA 0100 = 40 mA 0101 = 50 mA 0110 = 60 mA 0111 = 70 mA 1000 = 80 mA 1001 = 90 mA 1010 = 100 mA 1011 = 110 mA 1100 = 120 mA 1101 = 130 mA 1110 = 140 mA 1111 = 180 mA	Value at which a wire break detection message is generated and the output is switched off: 0 - 180 mA **B** Older module versions: – Module firmware ≤ version 3: 0 - 120 mA, – Module firmware version 4: 0 - 140 mA
Overcurrent detection threshold	0000 = 0 mA 0001 = 10 mA 0010 = 20 mA 0011 = 30 mA 0100 = 40 mA 0101 = 50 mA 0110 = 60 mA 0111 = 70 mA 1000 = 80 mA 1001 = 90 mA 1010 = 100 mA 1011 = 110 mA 1100 = 120 mA **A** 1101 = 130 mA 1110 = 140 mA 1111 = 180 mA	Value at which a overcurrent detection message is generated and the output is switched off: 0 - 180 mA **B** Older module versions: – Module firmware ≤ version 3: 0 - 120 mA, – Module firmware version 4: 0 - 140 mA
Activate wire break monitoring	no	
	yes **A**	
Activate overcurrent monitoring	no **A**	
	yes	

NOTE

If, in older modules, thresholds of > 120 mA are set, this setting is ignored and a threshold of 120 mA is used.

7.6.5 Base modules/pin assignment

- BL67-B-1M23-19

Figure 7-52:
BL67-B-1M23-19

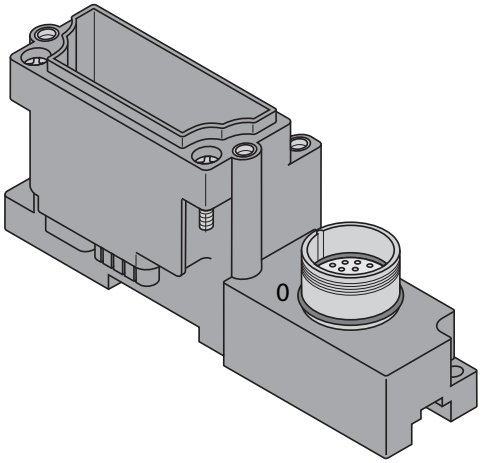
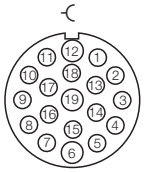


Figure 7-53:
Pin assignment
BL67-16DO-0.1A-P
with
BL67-B-1M23-19



1 = Output 14
2 = Output 10
3 = Output 6
4 = Output 3
5 = Output 2
6 = GND
7 = Output 1
8 = Output 5
9 = Output 9
10 = Output 13
11 = Output 12
12 = PE
13 = Output 11
14 = Output 7
15 = Output 0
16 = Output 4
17 = Output 8
18 = Output 15
19 = V_{SENS}

- BL67-B-8M8-4-P

Figure 7-54:
BL67-B-8M8-4-P

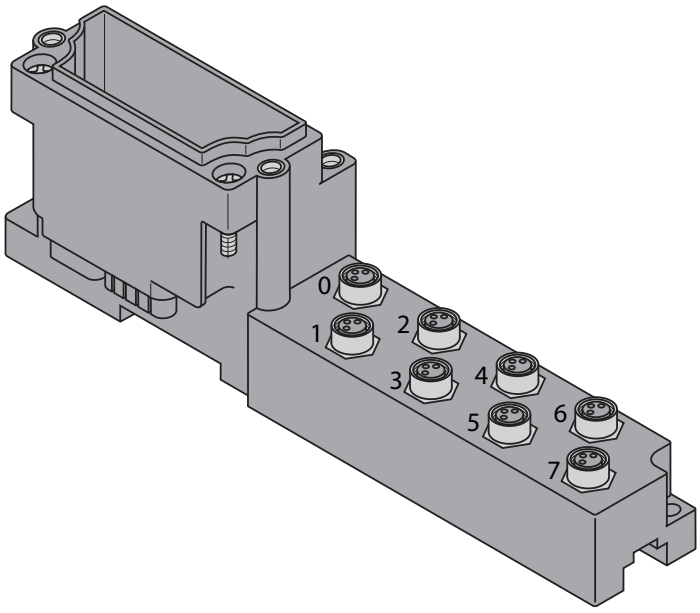
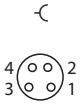


Figure 7-55:
Pin assignment
BL67-16DO-0.1A-P
with
BL67-B-8M8-4-P



1 = V_{SENS}
2 = Signal A
3 = GND
4 = Signal B

Signal assignment

Table 7-42: Signal assignment with BL67-B-1M23-19

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C0P14	C0P3	C0P8	C0P16	C0P4	C0P5	C0P7	C0P15
	m + 1	C0P18	C0P1	C0P10	C0P11	C0P13	C0P2	C0P9	C0P17

Table 7-43: Signal assignment with BL67-B-8M8-4-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4
	m + 1	C7P2	C7P4	C6P2	C6P4	C5P2	C5P4	C4P2	C4P4

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

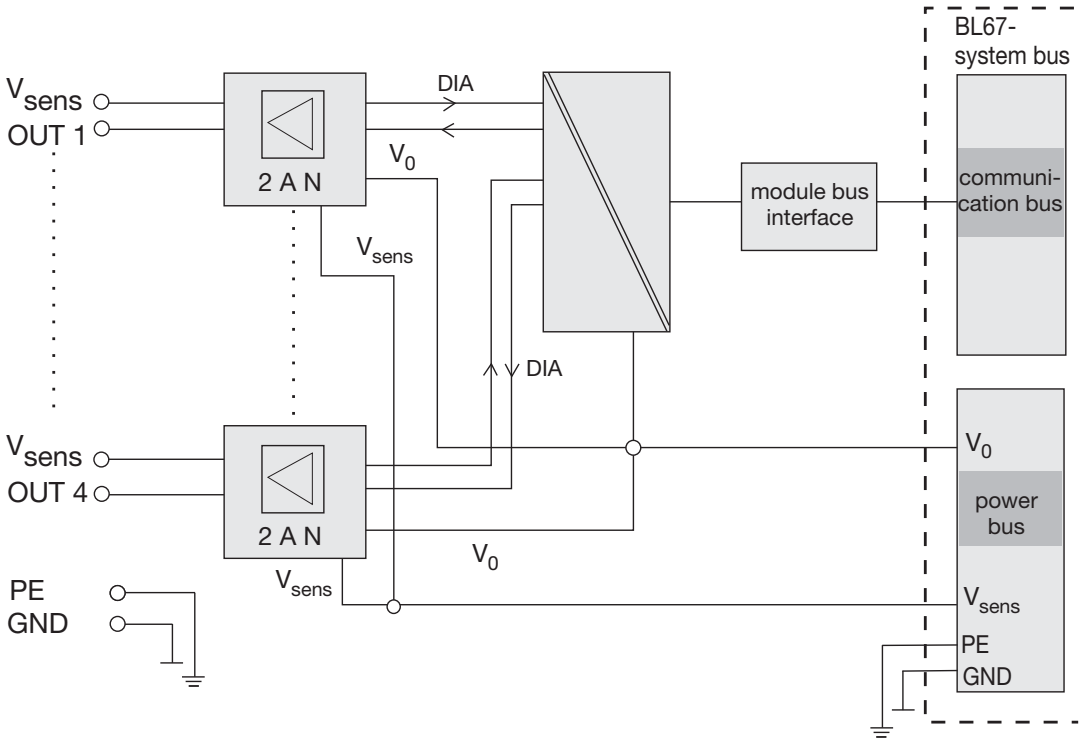
C = slot no.

P = pin no.

7.7 BL67-4DO-2A-N

Figure 7-56:
BL67-4DO-2A-N

Figure 7-57:
Block diagram



7.7.1 Technical data

Table 7-44: Technical data

Designation	BL67-4DO-2A-N
No. of channels	4
Nominal voltage from supply terminal	24 VDC
Load voltage V_O	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	< 100 mA (if load current = 0)
Power loss of the module, typical	< 1,5 W
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
High level $_A$ (nominal value)	2 A
High level I_{AMAX}	max. 3.6 A (according to IEC 61131-2)
Simultaneity factor	100 %
Switch-off characteristic K_A	
I_{OUT} > 6 A	< 4 ms
4 A < I_{OUT} < 6 A	< 10 s
2.2 A < I_{OUT} < 4 A	min. 10 s/max. 60 s
Delay at signal change and resistive load	
from low to high level	3 ms
from high to low level	3 ms
Load impedance range	12 Ω to 1 kΩ
Switch-on resistance R_{on}	max. 400 mΩ
Resistive, inductive and lamp loads can be connected	
Load impedance, resistive R_{LO}	12 Ω
Lamp load R_{LL}	6 W
Switching frequency	
resistive load	200 Hz
inductive load	2 Hz
lamp load	20 Hz
Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC

U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit proof	yes, according to EN 61 131-2

NOTE

The parallel switching of outputs is possible with the synchronous switching of the channels. In this case, the maximum output current can be increased up to 8 A, depending on the number of the parallel switched outputs.

7.7.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	-	-	-	-	DO3	DO2	DO1	DO0

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 7-45: Process data bits

Process data	Value	Meaning
DOx	0	Digital output inactive
	1	Digital output active

7.7.3 Diagnostic and status messages

LED status displays

Table 7-46: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	-
0 to 3	Green	Status of channel x = "1"	-
	Red	Short circuit/overload at channel x Overload at channel x	Eliminate the cause for the short-circuit or the overload. → After cooling the module switches on automatically.
	OFF	Status of channel x = "0"	-

Diagnostic data

This module has the following diagnostic data per channel:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	-	Overcurrent K3	Overcurrent K2	Overcurrent K1	Overcurrent K0

Table 7-47: Diagnostics

Diagnostics	
Overcurrent	Overcurrent or short-circuit at the output. The channel is switched off automatically. For the for switching-off characteristics of the outputs see Technical data Table 7-2.

7.7.4 Module parameters

none

7.7.5 Base modules/pin assignment

- BL67-B-4M8

Figure 7-58: BL67-B-4M8

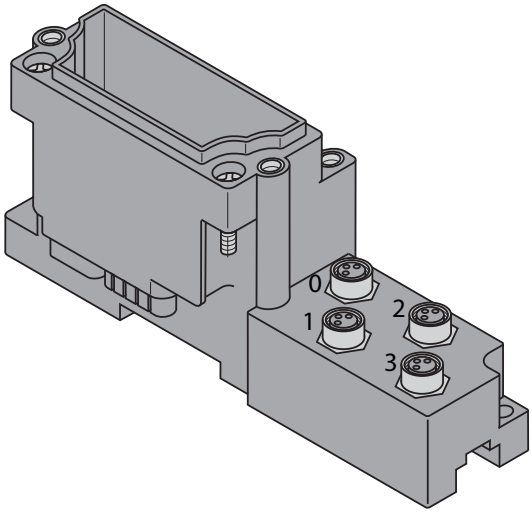


Figure 7-59: Pin assignment BL67-4DO-2A-N with BL67-B-4M8

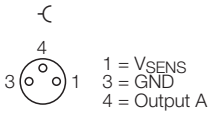
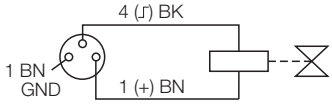


Figure 7-60: Wiring diagram BL67-4DO-2A-N with BL67-B-4M8



- BL67-B-2M12/BL67-B-2M12-P (paired)

Figure 7-61: BL67-B-2M12/ BL67-B-2M12-P

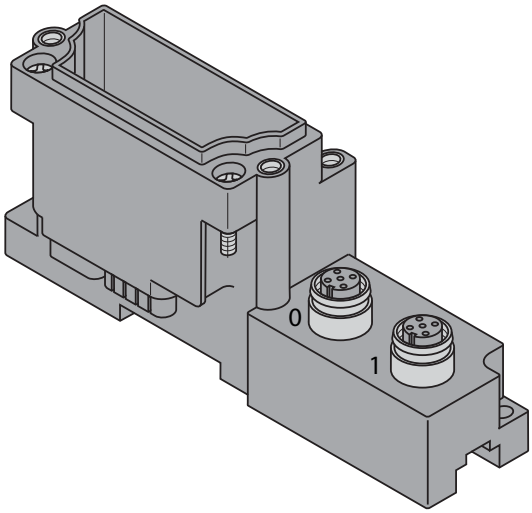


Figure 7-62:
Pin assignment
BL67-4DO-2A-N
with BL67-B-2M12/
BL67-B-2M12-P

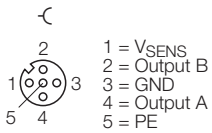
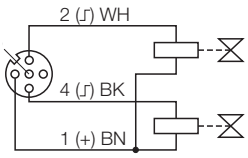


Figure 7-63:
Wiring diagram
BL67-4DO-2A-N
with BL67-B-2M12/
BL67-B-2M12-P



- BL67-B-4M12

Figure 7-64:
BL67-B-4M12

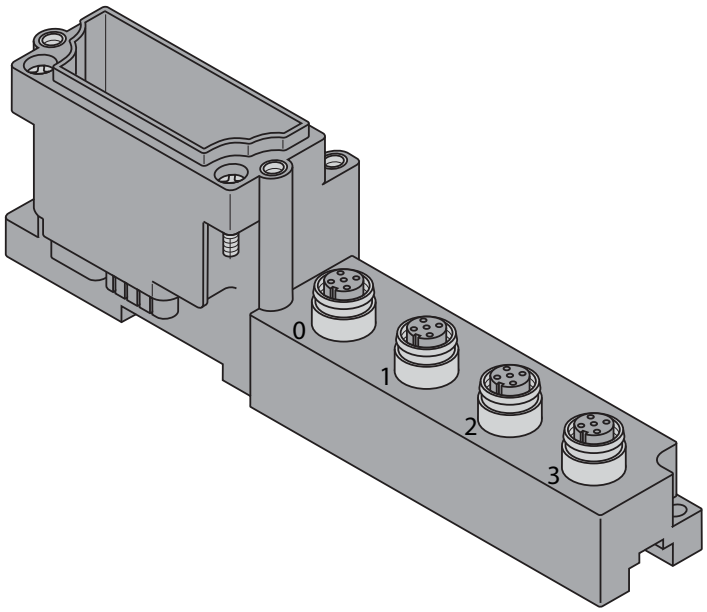


Figure 7-65:
Pin assignment
BL67-4DO-2A-N
with BL67-B-4M12

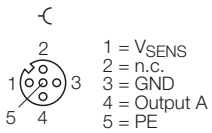
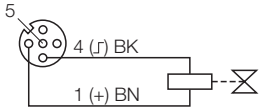
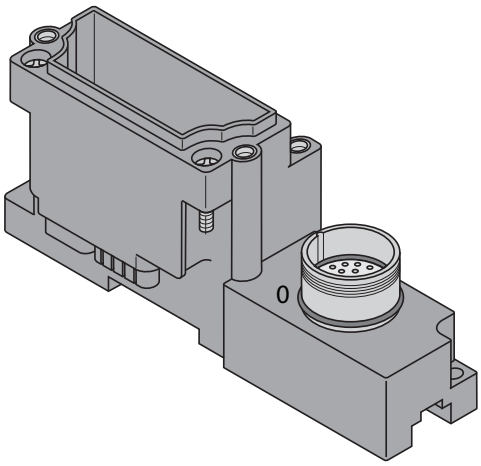


Figure 7-66:
Wiring diagram
BL67-4DO-2A-N
with BL67-B-4M12



- BL67-B-1M23

Figure 7-67: BL67-B-1M23



0

Figure 7-68: Pin assignment BL67-4DO-2A-N with BL67-B-1M23

1 = Signal 0
2 = Signal 1
3 = Signal 2
4 = Signal 3
5 = n.c.
6 = n.c.
7 = n.c.
8 = n.c.
9 = V_{SENS}
10 = V_{SENS}
11 = V_{SENS}
12 = GND

7.7.6 Signal assignment

Table 7-48: Signal assignment with BL67-B-4M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 7-49: Signal assignment with BL67-B-2M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C1P2	C0P2	C1P4	C0P4

Table 7-50: Signal assignment with BL67-B-2M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C1P2	C1P4	C0P2	C0P4

Table 7-51: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C3P4	C2P4	C1P4	C0P4

Table 7-52: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	-	-	-	-	C0P4	C0P3	C0P2	C0P1

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

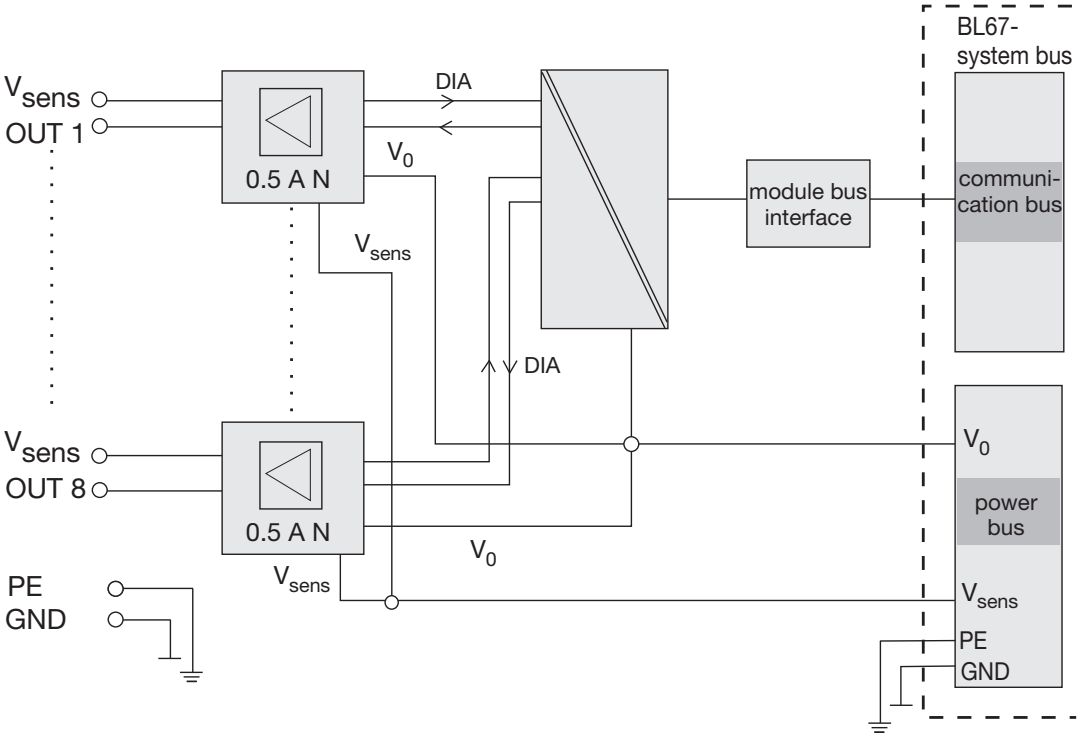
C = slot no.

P = pin no.

7.8 BL67-8DO-0.5A-N

Figure 7-69:
BL67-8DO-0.5A-N

Figure 7-70:
Block diagram



7.8.1 Technical data

Table 7-53: Technical data

Designation	BL67-8DO-0.5A-N
No. of channels	8
Nominal voltage from supply terminal	24 VDC
Load voltage V_O	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	< 100 mA (if load current = 0)
Power loss of the module, typical	< 1,5 W
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
High level $_A$ (nominal value)	0.5 A
High level I_{AMAX}	0.6 A (according to IEC 61131-2)
Simultaneity factor	100 %
Switch-off characteristic K_A	
I_{OUT} > 0.5 A	< 4 ms
1.0 A < I_{OUT} < 1.5 A	10 s
0,6 A < I_{OUT} < 1.0 A	min. 10 s/max. 60 s
Delay at signal change and resistive load	
from low to high level	3 ms
from high to low level	3 ms
Load impedance range	48 Ω to 1 kΩ
Switch-on resistance R_{on}	max. 800 mΩ
Resistive, inductive and lamp loads can be connected	
Load impedance, resistive R_{LO}	48 Ω
Lamp load R_{LL}	3 W
Switching frequency	
resistive load	200 Hz
inductive load	2 Hz
lamp load	20 Hz

Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit proof	yes, according to EN 61 131-2

NOTE

The parallel switching of outputs is possible with the synchronous switching of the channels. In this case, the maximum output current can be increased up to 4 A, depending on the number of the parallel switched outputs.

7.8.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	DO7	DO6	DO5	DO4	DO3	DO2	DO1	DO0

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 7-54: Process data bits

Process data	Value	Meaning
DOx	0	Digital output inactive
	1	Digital output active

7.8.3 Diagnostic and status messages

LED status displays

Table 7-55: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	-
0 to 7	Green	Status of channel x = "1"	-
	Red	Short circuit/overload at channel x Overload at channel x	Eliminate the cause for the short-circuit or the overload. → After cooling the module switches on automatically.
	OFF	Status of channel x = "0"	-

Diagnostic data

This module has the following diagnostic data per channel:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Overcurrent Ch7	Overcurrent Ch6	Overcurrent Ch5	Overcurrent Ch4	Overcurrent Ch3	Overcurrent Ch2	Overcurrent Ch1	Overcurrent Ch0

Table 7-56: Diagnostics

Diagnostics	
Overcurrent	Overcurrent or short-circuit at the output. The channel is switched off automatically. For the for switching-off characteristics of the outputs see Technical data Table 7-2.

7.8.4 Module parameters

none

7.8.5 Base modules/pin assignment

- BL67-B-8M8

Figure 7-71: BL67-B-8M8

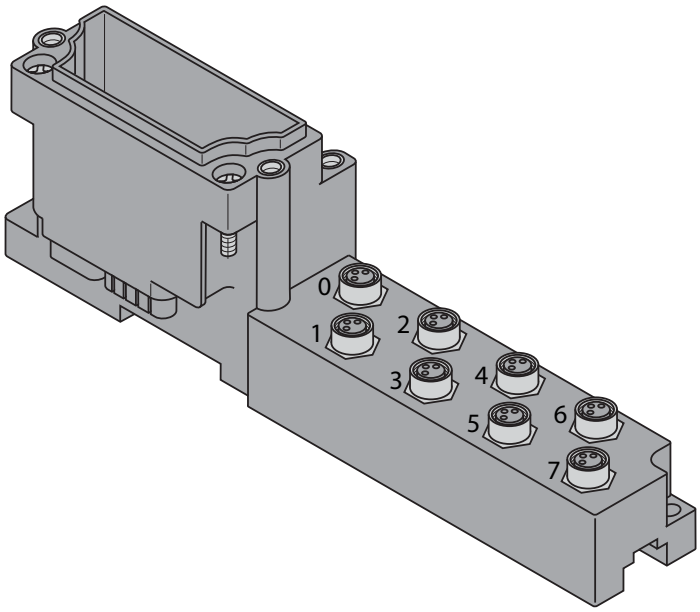


Figure 7-72: Pin assignment BL67-8DO-0.5A-N with BL67-B-8M8

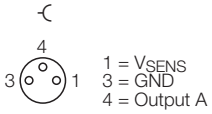
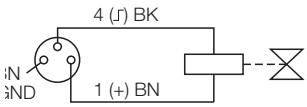


Figure 7-73: Wiring diagram BL67-8DO-0.5A-N with BL67-B-8M8



- BL67-B-4M12/BL67-B-4M12-P

Figure 7-74: BL67-B-4M12/ BL67-B-4M12-P

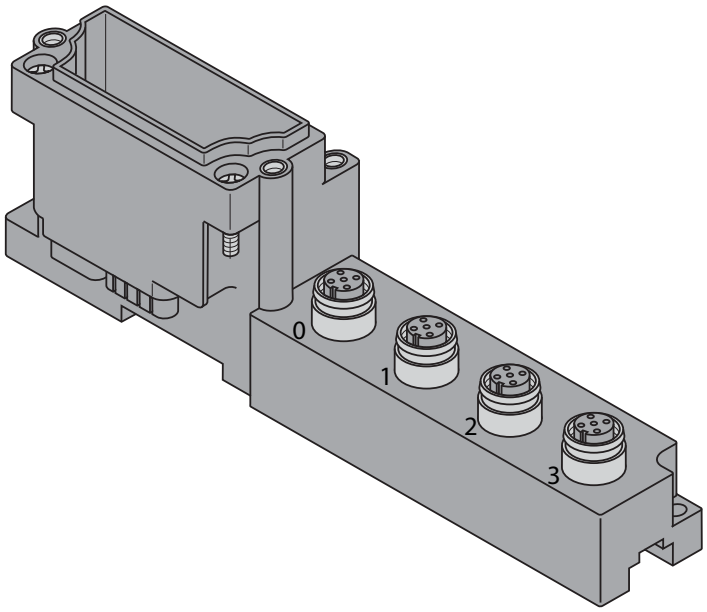


Figure 7-75: Pin assignment BL67-8DO-0.5A-N with BL67-B-4M12

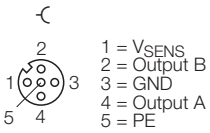
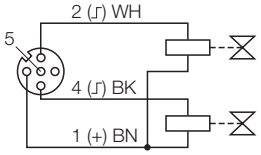


Figure 7-76: Wiring diagram BL67-8DO-0.5A-N with BL67-B-4M12



- BL67-B-1M23

Figure 7-77: BL67-B-1M23

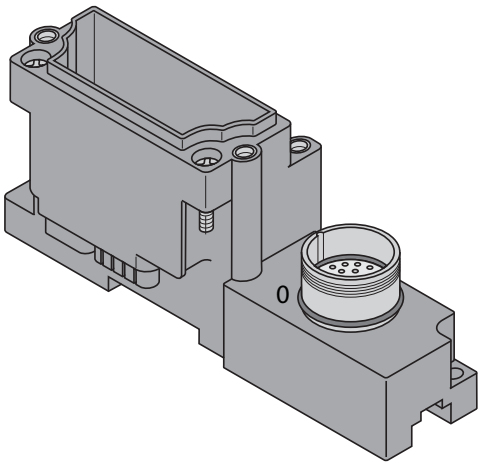
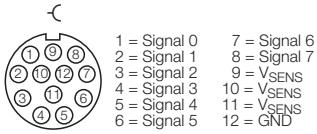


Figure 7-78: Pin assignment BL67-8DO-0.5A-N with BL67-B-1M23



7.8.6 Signal assignment

Table 7-57: Signal assignment with BL67-B-8M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4

Table 7-58: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C3P2	C2P2	C1P2	C0P2	C3P4	C2P4	C1P4	C0P4

Table 7-59: Signal assignment with BL67-B-4M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4

Table 7-60: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

C = slot no.

P = pin no.

8 Analog output modules

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8.1 Overview

Analog output modules (AO) receive output values from the gateway via the internal module bus. The modules convert these values and transmit the corresponding signals for each channel to the field level via the base modules.

The sensor supply (V_O) is tapped from the internal voltage supply bus.

The module bus electronics of the analog input modules are galvanically isolated from the field level via an opto-coupler, and provide reverse polarity protection.

The modules are short-circuit proof.

Supported signal ranges

- BL67-2AO-I:
  0 to 20 mA
  4 to 20 mA
- BL67-2AO-V/BL67-4AO-V:
  0 to 10 VDC
  -10 to 10 VDC

LED displays

Error signals from the I/O level are indicated by each module via the "D" LED. The corresponding diagnostic information is transmitted to the gateway via diagnostic bits.

8.1.1 Resolution of analog value representations

In the bipolar mode the digitalized analog values are represented as a two's complement. The 16 bit or the 12-bit-representation (left justified) can be chosen by setting the respective module parameter.

NOTE

A detailed description of the measurement value representation for the analog input modules in 16 or 12 bit can be found in the Appendix of this manual, page 15-8.

8.1.2 Module overview

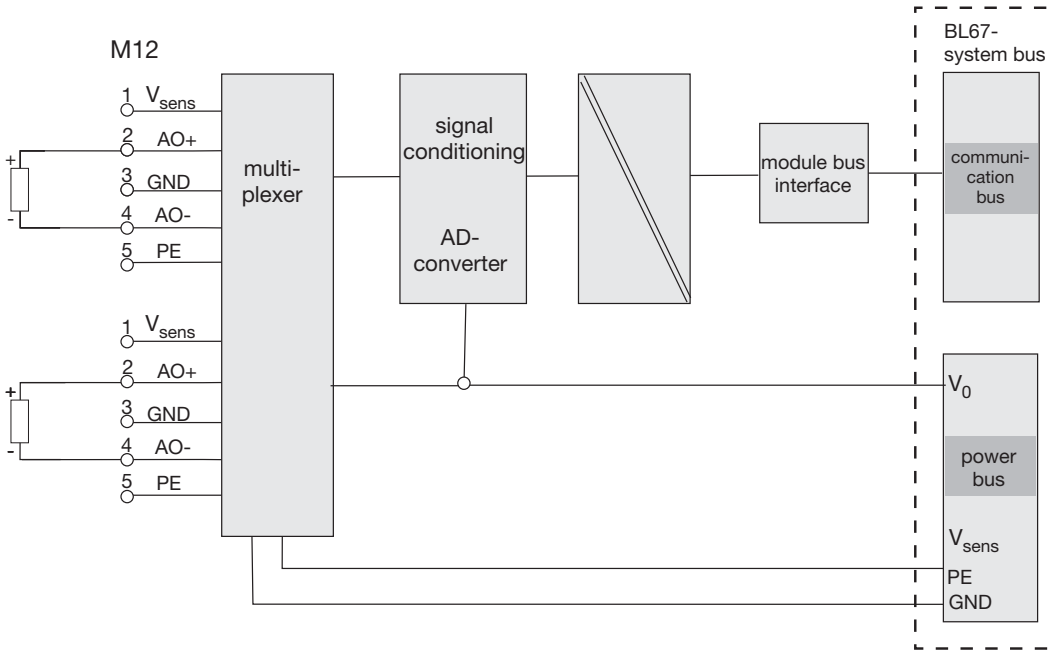
Table 8-1: Module overview

Module	No. of channels	Short-circuit proof
BL67-2AO-I	2	✓
BL67-2AO-V	2	✓
BL67-4AO-V	4	✓

8.2 BL67-2AO-I, 0/4 ... 20mA

Figure 8-1:
BL67-2AO-I

Figure 8-2:
Block diagram



8.2.1 Technical data

Table 8-2: Technical data

Designation	BL67-2AO-I
No. of channels	2
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 40 mA
Nominal current from supply terminal (field) I_L	≤ 50 mA
Power loss of the module, typical P_{MAX}	< 1 W
Output current I_A	0/4 to 20 mA
Burden resistance	
Resistive load R_{LO}	< 450 Ω
Inductive load R_{LI}	< 1 mH
Transmission frequency f_T	< 200 Hz
Basic error at 23 °C/73.4 °F	0.2 %
Repeat accuracy	0,05 %
Output ripple	0.02 %
Temperature coefficient	≤ 150 ppm/°C from end value
Settling time (maximum)	
Resistive load	0,1 ms
inductive load	0,5 ms
Isolation voltage	
U_{TMB} (module bus/field)	min. 500 V_{eff}
U_{Fe} (field/functional earth)	min. 50 VAC
channel/channel	none
channel/field supply	none
channel/system supply	500 V_{eff}
Measurement value representation	16 bit signed integer/ 12 bit full range, left-justified
I_{SENS} (actuator supply V_O)	≤ 250 mA per channel; short-circuit protection in Power Feeding module or gateway

NOTE

Negative values are automatically displayed as 0 mA or 4 mA, depending on the configured measurement range.

8.2.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	AO0 LSB							
	m + 1	AO0 MSB							
	m + 2	AO1 LSB							
	m + 3	AO1 LSB							

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 8-3: Process data bits

Process data	Meaning
AOx LSB	low byte of the analog value
AOx LSB	high byte of the analog value

8.2.3 Diagnostic and status messages

LED status displays

Table 8-4: LED status displays

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	no error message or diagnostics	–

8.2.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Output range
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	reserved
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	Output on module bus error
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	Data representation
		Bit 7		Bit 7		Bit 7	
	Byte 1	Bit 0		Bit 8	Byte 2	Bit 0	Substitute value (low byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
	Byte 2	Bit 0	Word 1	Bit 0	Byte 1	Bit 0	Substitute value (high byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 1	Byte 3	Bit 0	Word 1	Bit 8	Byte 3	Bit 0	Output range
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	reserved
		Bit 3		Bit 11		Bit 3	Deactivate channel
		Bit 4		Bit 12		Bit 4	Output on module bus error
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	Data representation
		Bit 7		Bit 15		Bit 7	
	Byte 4	Bit 0	Word 2	Bit 0	Byte 5	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 5	Bit 0		Bit 8	Byte 4	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

Table 8-5: Module parameters

A *default setting*

Parameter name	Value
Output range	0 = 0 … 20 mA **A** 1 = 4 … 20 mA
Data format	0 = 15 bit + sign **A** 1 = 12 bit (left-justified)
Deactivate channel	0 = no **A** 1 = yes
Output on module bus error	0 = substitute value **A** 1 = current value
Data representation	00 = standard **A** 01 = NE 43 10 = extended range
Substitute value	Substitute value = "0" **A** The substitute value will be transmitted if the respective parameters of the gateway have been set to "output substitute value" if the communication between module and gateway is disturbed.

NOTE

Concerning the "number representation", please observe the tables for measurement value representation on the following pages.

8.2.5 Measurement value representation

Standard value representation

- 16-bit-representation

dec.	hex.	0 ... 20 mA	4 ... 20 mA
		dec. value = 1638,35 [1/mA] × current value	dec. value = 2047.94 × (current value [mA]- 4 mA)
32767	7FFF	20.0000 mA	20.0000 mA
32766	7FFE	19.9994 mA	19.9995 mA
…	…	…	…
16384	4000	10.0003 mA	12.00024 mA
…	…	…	…
1	0001	0.0006103 mA	4.0004883 mA
0	0000	0.000000 mA	4.000000 mA
-1	FFFF	0.000000 mA	4.000000 mA
…	…	…	…
-16384	C000	0.000000 mA	4.000000 mA
…	…	…	…
-32767	8001	0.000000 mA	4.000000 mA
-32768	8000	0.000000 mA	4.000000 mA

- 12-bit-representation (left-justified)

dec.	hex.	0 ... 20 mA	4 ... 20 mA
		dec. value = 204.75 [1/mA] × current value [mA] × 16	dec. value = 255,9 [1/mA] × (current value [mA] - 4 mA) × 16
4095 × 16	FFF×	20.0000 mA	20.0000 mA
4094 × 16	Flex	19.995117 mA	19.99609 mA
…	…	…	…
2048 × 16	800×	10.0024 mA	12.0019 mA
…	…	…	…
1 × 16	001×	0.004883 mA	4.00391 mA
0	000×	0.000000 mA	4.000000 mA

Extended range - value representation

- 16-bit-representation

dec.	hex.		0 ... 20 mA
dec. value = 1382,4 [1/mA] × current value [mA]			
32767	7FFF		23.703 mA
32752	7FFF		23.692 mA
32512	7F00		23.5185 mA
32511	7EFF	out of range	23.5178 mA
32496	7EF0		23.507 mA
27664	6C10		20.0116 mA
27649	6C01		20.0007 mA
27648	6C00	nominal range	20 mA
16	0010		11,574 µA
1	0001		0,7234 µA
0	0000		0.0000 mA
-1	FFFF		0.0000 mA
-16	FFF0		0.0000 mA
-6912	E500		0.0000 mA
-27648	9400		0.0000 mA
-27649	93FF		0.0000 mA
-27664	93F0		0.0000 mA
-32512	8100		0.0000 mA
-32513	80FF		0.0000 mA
-32752	80F0		0.0000 mA
-32768	8000		0.0000 mA

dec.	hex.		4 ... 20 mA
dec. value = 1728 [1/mA] × (current value [mA] - 4 mA)			
32767	7FFF		22.962 mA
32752	7FF0		22.954 mA
32512	7F00		22.8148 mA
32511	7EFF	out of range	22.8142 mA
32496	7EF0		22.8056 mA
27664	6C10		20.0093 mA
27649	6C01		20.0006 mA
27648	6C00	nominal range	20 mA
16	0010		4.009259 mA
1	0001		4.000578 mA
0	0000		4.0000 mA
-1	FFFF	out of range	3.99942 mA
-16	FFF0		3.99075 mA
-6912	E500		0.0000 mA
-6913	E4FF		0.0000 mA
-27648	9400		0.0000 mA
-27649	93FF		0.0000 mA
-27664	93F0		0.0000 mA
-32512	8100		0.0000 mA
-32513	80FF		0.0000 mA
-32752	80F0		0.0000 mA
-32768	8000		0.0000 mA

- 12-bit-representation (left-justified)

The representation of the 12 bit values corresponds to that of the 16 bit values. Only bits 0 to 3 are set to "0".

Value representation process automation (NE 43)

- 16-bit-representation

The hexadecimal value transmitted by the module has to be interpreted as decimal value, which corresponds, if multiplied with a defined factor, to the analog value.

Example:

Process value:	
– dec.	15020
– hex.	3AAC
Output current	15.02 mA

dec.	hex.		0 ... 20 mA
dec. value = 1000 [1/mA] × current value [mA]			
65535	FFFF		22.000 mA
22001	55F1		22.000 mA
22000	55F0		22.000 mA
21001	5209		21.001 mA
21000	5208	out of range	21.000 mA
20001	4E21		20.001 mA
20000	4E20	nominal range	20.000 mA
8000	1F40		8.000 mA
4000	0FA0		4.000 mA
2	0002		0.002 mA
1	0001		0.001 mA
0	0000		0.000 mA

dec.	hex.		4 ... 20 mA
dec. value = 1000 [1/mA] × current value [mA]			
65535	FFFF		22.000 mA
22001	55F1		22.001 mA
22000	55F0		22.000 mA
21001	5209		21.001 mA
21000	5208	out of range	21.000 mA
20001	4E21		20.001 mA
20000	4E20	nominal range	20.000 mA
8000	1F40		8.000 mA
4000	0FA0		4.000 mA
≤ 3999	0F9F	out of range	3.999 mA
3800	0ED8		3.800 mA
3600	0E10		3.600 mA
3599	0E0F		3.599 mA
2000	07D0		2.000 mA
< 1999	07CF		1.999 mA
1	0001		0.001 mA
0	0000		0.000 mA

- 12-bit-representation (left-justified)
  The representation of the 12 bit values corresponds to that of the 16 bit values. Only bits 0 to 3 are set to "0".

8.2.6 Base modules/pin assignment

- BL67-B-2M12

Figure 8-3: BL67-B-2M12

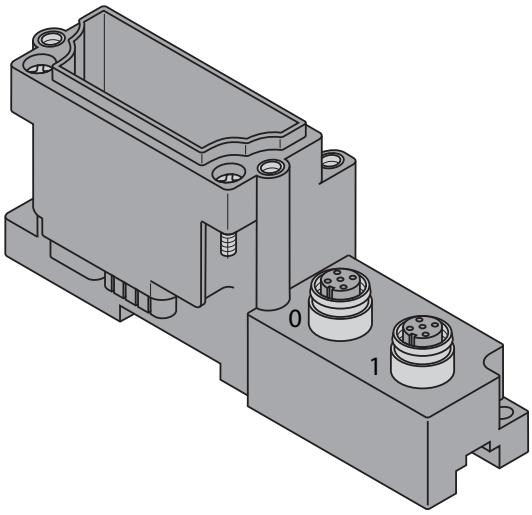
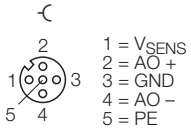


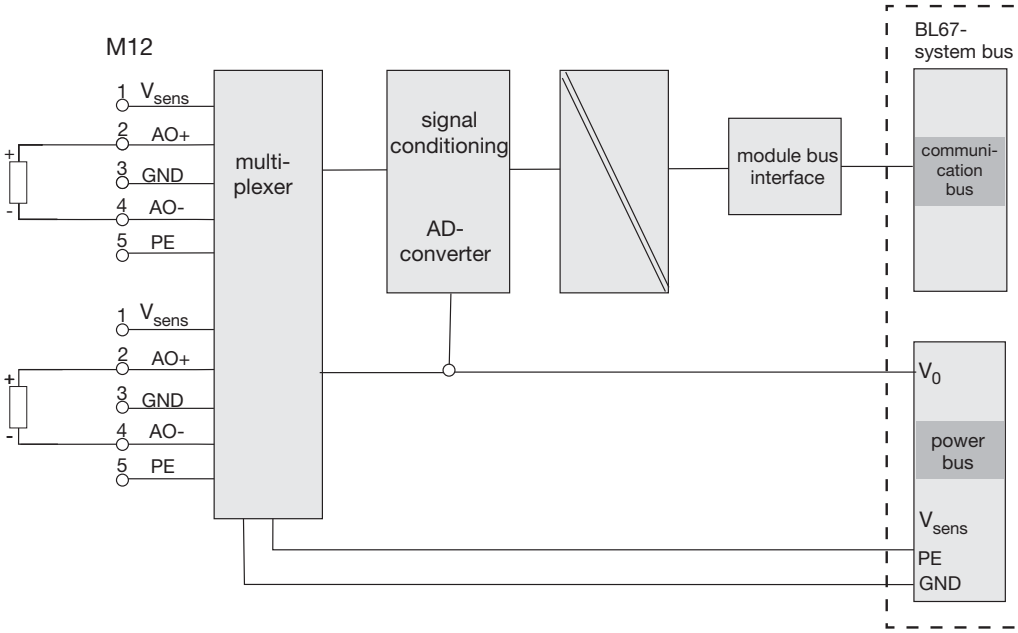
Figure 8-4: Pin assignment BL67-2AO-I with BL67-B-2M12



8.3 BL67-2AO-V, -10/0 ... +10VDC

Figure 8-5:
BL67-2AO-V

Figure 8-6:
Block diagram



8.3.1 Technical data

Table 8-6: Technical data

Designation	BL67-2AO-V
No. of channels	2
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 60 mA
Nominal current from supply terminal (field) I_L	≤ 50 mA
Power loss of the module, typical P_{MAX}	< 1 W
Output voltage U_A	-10/0 to 10 VDC
Burden resistance	
Resistive load R_{LO}	> 1 kΩ
Capacitive load R_{Lk}	< 1 µF
Short-circuit current I_K	≤ 40 mA
Transmission frequency f_T	< 100 Hz
Basic error at 23 °C/73.4 °F	0.2 %
Repeat accuracy	0,05 %
Output ripple	0.02 %
Temperature coefficient	≤ 300 ppm/°C from end value
Settling time (maximum)	
Resistive load	0,1 ms
inductive load	0,5 ms
Isolation voltage	
U_{TMB} (module bus/field)	min. 500 V_{eff}
U_{Fe} (field/functional earth)	min. 50 V_{AC}
channel/channel	none
channel/field supply	none
channel/system supply	500 V_{eff}
Measurement value representation	16 bit signed integer/ 12 bit full range, left-justified
I_{SENS} (actuator supply V_O)	≤ 250 mA per channel; short-circuit protection in Power Feeding module or gateway

NOTE

Negative values are automatically displayed as 0 V in a configured measurement range of 0 to 10 V.

8.3.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	AO0 LSB							
	m + 1	AO0 MSB							
	m + 2	AO1 LSB							
	m + 3	AO1 LSB							

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 8-7: Process data bits

Process data	Meaning
AOx LSB	low byte of the analog value
AOx LSB	high byte of the analog value

8.3.3 Diagnostic and status messages

LED status displays

Table 8-8: LED status displays

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–

8.3.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Output range
		Bit 1		Bit 1		Bit 1	Data format
		Bit 2		Bit 2		Bit 2	reserved
		Bit 3		Bit 3		Bit 3	Deactivate channel
		Bit 4		Bit 4		Bit 4	Output on module bus error
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	Data representation
		Bit 7		Bit 7		Bit 7	
	Byte 1	Bit 0		Bit 8	Byte 2	Bit 0	Substitute value (low byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
	Byte 2	Bit 0	Word 1	Bit 0	Byte 1	Bit 0	Substitute value (high byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 1	Byte 3	Bit 0	Word 1	Bit 8	Byte 3	Bit 0	Output range
		Bit 1		Bit 9		Bit 1	Data format
		Bit 2		Bit 10		Bit 2	reserved
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
	Byte 4	Bit 0	Word 2	Bit 0	Byte 5	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 5	Bit 0		Bit 8	Byte 4	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

Table 8-9: Module parameters

A *default setting*

Parameter name	Value
Output range	0 = 0 … +10 V **A** 1 = -10 … +10 V
Data format	0 = 15 bit + sign **A** 1 = 12 bit (left-justified)
Substitute value	Substitute value = "0" **A** The substitute value will be transmitted if the respective parameters of the gateway have been set to "output substitute value" or if the communication between module and gateway is disturbed.

8.3.5 Base modules/pin assignment

- BL67-B-2M12

Figure 8-7: BL67-B-2M12

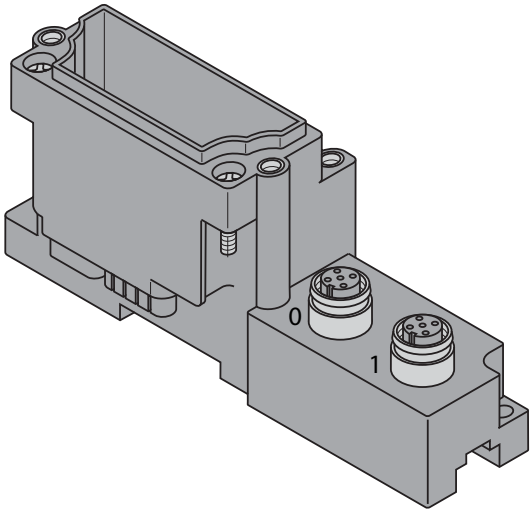
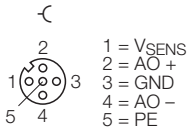


Figure 8-8: Pin assignment BL67-2AO-I with BL67-B-2M12



8.3.6 Measurement value representation

16-bit-representation

- Voltage values from 0 to 10 VDC

  The value range:
  0 V to 10 V
  is displayed as follows:
  0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

- Voltage values from -10 to 10 V DC

  The value range:
  0 V to 10 V
  is displayed as follows:
  0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

  The value range:
  -10 V to -3,052 10^{-4} V
  is displayed as follows:
  8000_{hex} to $FFFF_{hex}$ (decimal:-32768 to -1)

12-bit-representation (left-justified)

- Voltage values from 0 to 10 VDC

  The value range:
  0 V to 10 V
  is displayed as follows:
  000_{hex} to FFF_{hex} (decimal: 0 to 4095)

- Voltage values from -10 to 10 VDC

  The value range:
  0 V to 10 V
  is displayed as follows:
  000_{hex} to $7FF_{hex}$ (decimal: 0 to 2047)

  The value range:
  -10 V to -0.0049 V
  is displayed as follows:
  800_{hex} to FFF_{hex} (decimal: -2048 to -1)

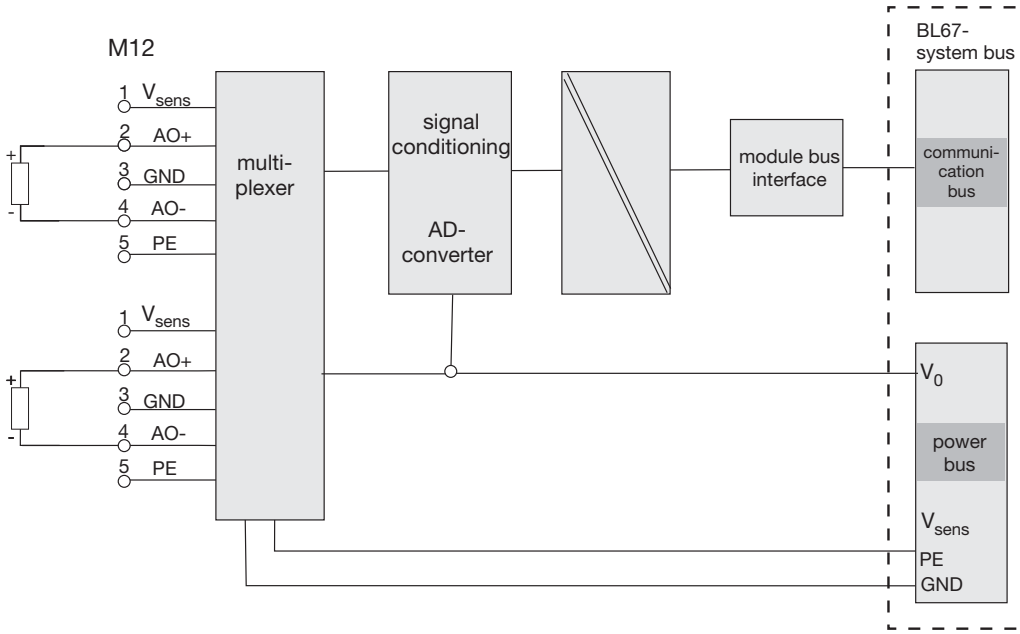
NOTE

A detailed description of the measurement value representation for the analog input modules in 16 or 12 bit can be found in the Appendix of this manual, page 15-22.

8.4 BL67-4AO-V, -10/0 ... +10 VDC

Figure 8-9:
BL67-4AO-V

Figure 8-10:
Block diagram



8.4.1 Technical data

Table 8-10: Technical data

Designation	BL67-4AO-V
No. of channels	4
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 50 mA
Nominal current from supply terminal (field) I_L	≤ 50 mA
Power loss of the module, typical P_{MAX}	< 1 W
Output signal	
Output voltage U_A	-10/0 to 10 VDC
Burden resistance	
– Resistive load R_{LO}	> 1 kΩ
– Capacitive load R_{Lk}	< 1 µF
Short-circuit current I_K	≤ 40 mA
Transmission frequency f_T	< 100 Hz
Basic error at 23 °C/73.4 °F	0.3 %
Repeat accuracy	0,05 %
Output ripple	0.02 %
Temperature coefficient	≤ 300 ppm/°C from end value
Settling time (maximum)	
– Resistive load	max. 0,5 ms
– inductive load	max. 2,0 ms
– capacitive load	max. 2,0 ms
Common mode error	min. 90 dB
Differential mode error	min. 70 dB
Crosstalk (channel to channel)	min. - 50 dB
Isolation voltages	
U_{TMB} (module bus/field)	min. 500 VDC
U_{PE} (field/PE)	min. 500 VDC
Resolution of the A/D converter	16 bit

NOTE

Negative values are automatically displayed as 0 V in a configured measurement range of 0 to 10 V.

8.4.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Output	m	AO0 LSB							
	m + 1	AO0 MSB							
	m + 2	AO1 LSB							
	m + 3	AO1 LSB							
	m +4	AO2 LSB							
	m + 5	AO2 MSB							
	m + 6	AO3 LSB							
	m + 7	AO3 MSB							

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 8-11: Process data bits

Process data	Meaning
AOx LSB	low byte of the analog value
AOx LSB	high byte of the analog value

8.4.3 Diagnostic and status messages

LED status displays

Table 8-12: LED status displays

LED	Display	Meaning	Remedy
D	red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–
0 to 4	Green	Input channel x active	-
	Green flashing, 0.5 Hz	Underflow diagnostic at input	-
	Green flashing, 4 Hz	Overflow diagnostic at input	-
	OFF	Input channel x inactive	

Diagnostic data

This module has the following diagnostic data **per channel**:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Hardware-error	-	-	-	Overflow/ underflow (NE 43 only)	-	-	Output value out of range

Table 8-13: diagnostics

Diagnostics	Meaning
Output value out of range	Underrun/overrun of the valid output range (limit values see page 8-27ff.)
Overflow/underflow (NE 43 only)	The output value lies under or over the set output value and can not be given out (limit values see page 8-31ff.)
Hardware failure	Shows common errors of the module hardware (e.g. CRC-error, calibration error, …). The return analog value in case of an error is "0". Module exchange necessary!

8.4.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Operation mode
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	Data format
		Bit 5		Bit 5		Bit 5	Deactivate diagnostics
		Bit 6		Bit 6		Bit 6	Output on module bus error
		Bit 7		Bit 7		Bit 7	
	Byte 1	Bit 0		Bit 8	Byte 2	Bit 0	Substitute value (low byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
	Byte 2	Bit 0	Word 1	Bit 0	Byte 1	Bit 0	Substitute value (high byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
Channel 1	Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	Operation mode
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	Data format
		Bit 5		Bit 13		Bit 5	Deactivate diagnostics
		Bit 6		Bit 14		Bit 6	Output on module bus error
		Bit 7		Bit 15		Bit 7	

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 1	Byte 4	Bit 0	Word 2	Bit 0	Byte 5	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 5	Bit 0		Bit 8	Byte 4	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
Channel 2	Byte 6	Bit 0	Word 3	Bit 0	Byte 6	Bit 0	Operation mode
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	Data format
		Bit 5		Bit 5		Bit 5	Deactivate diagnostics
		Bit 6		Bit 6		Bit 6	Output on module bus error
		Bit 7		Bit 7		Bit 7	
	Byte 7	Bit 0		Bit 8	Byte 8	Bit 0	Substitute value (low byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
	Byte 8	Bit 0	Word 4	Bit 0	Byte 7	Bit 0	Substitute value (high byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
Channel 3	Byte 9	Bit 0	Word 4	Bit 8	Byte 9	Bit 0	Operation mode
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	Data format
		Bit 5		Bit 13		Bit 5	Deactivate diagnostics
		Bit 6		Bit 14		Bit 6	Output on module bus error
		Bit 7		Bit 15		Bit 7	
	Byte 10	Bit 0	Word 5	Bit 0	Byte 11	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 11	Bit 0		Bit 8	Byte 10	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

.

Table 9: Module parameters

Parameter	**settings**
Operation mode	0000 = voltage -10 … 10 V DC standard **A** 0001 = voltage 0 … 10 V DC standard 0010 = voltage -10 … 10 V DC PA (NE 43) 0011 = voltage 0 … 10 V DC PA (NE 43) 0100 = voltage -10 … 10 V DC extended range 0101 = voltage 0 … 10 V DC extended range 1111 = deactivate
Data format	0 = 15 bit + sign **A** 1 = 12 bit (left-justified)
Deactivate diagnostics	0 = no **A** 1 = yes
Output on module bus error	0 = substitute value **A** 1 = current value
Substitute value	Substitute value = "0" **A** The substitute value will be transmitted if the respective parameters of the gateway have been set to "output substitute value" or if the communication between module and gateway is disturbed.

A *default settings*

8.4.5 Measurement value representation

Standard representation

- 16-bit-representation

	dec.	hex.	bipolar	-10 ... 10 V
dec. value = 3276,7 [1/V] × voltage value [V]				
100.00 %	32767	7FFF	nominal range	10.0000 V
99.99695 %	32766	7FFE		9.9997 V
	…	…		…
50.00153 %	16384	4000		5.0002 V
	…	…		…
0.00305 %	1	0001		0.000305 V
0.00000 %	0	0000		0.000000 V
-0.00305 %	-1	FFFF		-0.000305 V
	…	…		…
-50.00000 %	-16384	C000		-5.0000 V
	…	…		…
-99.99695 %	-32767	8001		-9.9997 V
-100.00 %	-32768	8000		- 10,0000 V

	dec.	hex.	unipolar	0 ... 10 V
dec. value = 3276,7 [1/V] × voltage value [V]				
100.00 %	32767	7FFF	nominal range	10.0000 V
99.99695 %	32766	7FFE		9.9997 V
	…	…		…
50.00153 %	16384	4000		5.0002 V
	…	…		…
0.00305 %	1	0001		0.000305 V
0.00000 %	0	0000		0.000000 V
-0.00305 %	-1	FFFF	DIA Output value out of range ON at FFFF to 8000	0.000000 V
	…	…		…
-50.00000 %	-16384	C000		0.000000 V
	…	…		…
-99.99695 %	-32767	8001		0.000000 V
-100.00 %	-32768	8000		0.000000 V

- 12-bit-representation (left-justified)

	dec.	hex.	bipolar	-10 ... 10 V
dec. value = 204,7 [1/V] × voltage value [V] × 16				
100.000 %	2047 × 16	7FFF	nominal range	10.0000 V
99.951 %	2046 × 16	7FEx		9.9951 V
	…	…		…
0.04885 %	1 × 16	001×		0.004885 V
0.00000 %	0	000×		0.000000 V
-0.04883 %	-1 × 16	FFF×		-0.004883 V
	…	…		…
-99.95 %	-2047 × 16	801×		-9.9951 V
-100.00 %	-2048 × 16	800×		- 10,0000 V

	dec.	hex.	unipolar	0 ... 10 V
dec. value = 409,5 [1/V] × voltage value [V] × 16				
100.00 %	4095 × 16	FFF×	nominal range	10.0000 V
99.976 %	4094 × 16	FFEx		9.9976 V
	…	…		…
50.012%	2048 × 16	800×		5.0021 V
	…	…		…
0.0244 %	1 × 16	001×		0.002442 V
0.00000 %	0	000×		0.000000 V

Extended range - value representation

- 16-bit-representation

	dec.	hex.	bipolar	-10 ... 10 V
dec. value = 2764,8 [1/V] × voltage value [V]				
118.515 %	32767	7FFF	DIA Output value out of range ON at 7F00 to 7FFF	11.851 V
118.461 %	32752	7FF0		11.846 V
117.593 %	32512	7F00		11.7593 V
117.589 %	32511	7EFF	out of range	11.7589 V
117.535 %	32496	7EF0		11.7535 V
100.058%	27664	6C10		10.0058 V
≥ 100,004 %	27649	6C01		10.0004 V
100.000 %	27648	6C00	nominal range	10 V
0.05787 %	16	0010		5.787 mV
0.003617 %	1	0001		361,7 µV
0.000 %	0	0000		0 V
-0.00362 %	-1	FFFF		-361,7 µV
-0.05787 %	-16	FFF0		- 5,787 mV
-25.000 %	-6912	E500		-2.5 V
-100.000 %	-27648	9400		-10 V
≤ -100,004 %	-27649	93FF	out of range	-10.0004 V
-100.058 %	-27664	93F0		-10.0058 V
-117.593 %	-32512	8100		-11.7593 V
-117.596 %	-32513	80FF	DIA Output value out of range ON at 08FF to 8000	11.7596 V
-118.461 %	-32752	80F0		-11.846 V
-118.519 %	-32768	8000		-11.852 V

	dec.	hex.	unipolar	0 ... 10 V
dec. value = 2764,8 [1/V] × voltage value [V]				
118.515 %	32767	7FFF	DIA Output value out of range ON at 7F00 to 7FFF	11.851 V
118.461 %	32752	7FF0		11.846 V
117.593 %	32512	7F00		11.7593 V
117.589 %	32511	7EFF	out of range	11.7589 V
117.535 %	32496	7EF0		11.7535 V
100.058%	27664	6C10		10.0058 V
≥ 100,004 %	27649	6C01		10.0004 V
100.000 %	27648	6C00	nominal range	10 V
0.05787 %	16	0010		5.787 mV
0.003617 %	1	0001		361,7 µV
0.000 %	0	0000		0.00 V
-0.00362 %	-1	FFFF	DIA Output value out of range ON at FFFF to 8000	0.00 V
-0.05787 %	-16	FFF0		0.00 V
-25.000 %	-6912	E500		0.00 V
-100.000 %	-27648	9400		0.00 V
≤ -100,004 %	-27649	93FF		0.00 V
-100.058 %	-27664	93F0		0.00 V
-117.593 %	-32512	8100		0.00 V
-117.596 %	-32513	80FF		0.00 V
-118.461 %	-32752	80F0		0.00 V
-118.519 %	-32768	8000		0.00 V

- 12-bit-representation (left-justified)

The representation of the 12 bit values corresponds to that of the 16 bit values. Only bits 0 to 3 are set to "0".

Value representation process automation (NE 43)

- 16-bit-representation

	dec.	hex.	bipolar	-10 ... 10 V
dec. value = 1000 [1/V] × voltage value [V]				
327.67 %	32767	7FFF	DIA Overflow/underflow ON at 2AF9 to 7FFF	11.000 V
110, 01 %	11001	2AF9		11.000 V
110.00 %	11000	2AF8	DIA Output value out of range ON at 2905 to 7FFF	11.000 V
105.01 %	10501	2905		10.501 V
105.00 %	10500	2904	out of range	10.500 V
100.01 %	10001	2711		10.001 V
100.000 %	10000	2710	nominal range	10.000 V
40.00 %	4000	0FA0		4.000 V
0.01 %	1	0001		0.001 V
0.000 %	0	0000		0 V
-0.01 %	-1	FFFF		-0.001 V
-40.00 %	-4000	F060		-4.000 V
-100.00 %	-10000	D8F0		-10.000 V
≤ -100,01 %	-10001	D8EF	out of range	-10.001 V
-105.00 %	-10500	D6FC		-10.500 V
-105.01 %	-10501	D6FB	DIA Output value out of range ON at D6FB to 8000	-10.501 V
-110.00 %	-11000	D508		-11.000 V
-110.01 %	-11001	D507	DIA Overflow/underflow ON at D507 to 8000	-11,00 0 V
-327.68 %	-32768	8000		-11.000 V

	dec.	hex.	unipolar	0 ... 10 V
dec. value = 1000 [1/V] × voltage value [V]				
655.35 %	65535	FFFF	DIA Overflow/underflow ON at 2AF9 to FFFF	11.000 V
110, 01 %	11001	2AF9		11.000 V
110.00 %	11000	2AF8	DIA Output value out of range ON at 2905 to FFFF	11.000 V
105.01 %	10501	2905		10.501 V
105.00 %	10500	2904	out of range	10.500 V
100.01 %	10001	2711		10.001 V
100.000 %	10000	2710	nominal range	10.000 V
40.00 %	4000	0FA0		4.000 V
20.00 %	2000	07D0		2.000 V
0.01 %	1	0001		0.001 V
0.000 %	0	0000		0 V

- 12-bit-representation (left-justified)

The representation of the 12 bit values corresponds to that of the 16 bit values. Only bits 0 to 3 are set to "0".

8.4.6 Base modules/pin assignment

- BL67-B-4M12

Figure 8-11: BL67-B-4M12

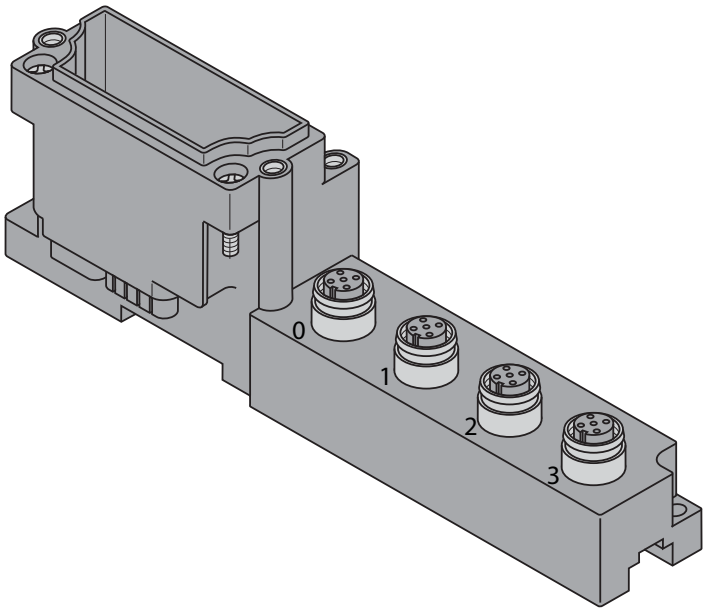
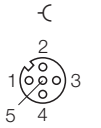


Table 8-1: Pin assignment BL67-4AO-V with BL67-B-4M12



1 = V_{SENS}
2 = AO +
3 = GND
4 = AO –
5 = PE

- BL67-B-2M12-8/ BL67-B-2M12-8-P

Figure 8-12: BL67-B-2M12/ BL67-B-2M12-8-P

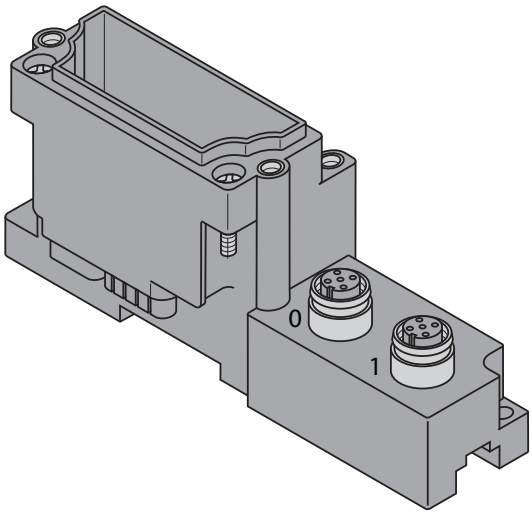


Table 8-2: Pin assignment BL67-4AO-V with BL67-B-2M12-8

slot 0:

1 = AO 0 –	5 = V_{SENS}
2 = AO 2 –	6 = V_{SENS}
3 = AO 0 +	7 = GND
4 = AO 2 +	8 = PE

slot 1:

1 = AO 1 –	5 = V_{SENS}
2 = AO 3 –	6 = V_{SENS}
3 = AO 1 +	7 = GND
4 = AO 3 +	8 = PE

Table 8-3: Pin assignment BL67-4AO-V with BL67-B-2M12-8-P

slot 0:

1 = AO 0 –	5 = V_{SENS}
2 = AO 1 –	6 = V_{SENS}
3 = AO 0 +	7 = GND
4 = AO 1 +	8 = PE

slot 1:

1 = AO 2 –	5 = V_{SENS}
2 = AO 3 –	6 = V_{SENS}
3 = AO 2 +	7 = GND
4 = AO 3 +	8 = PE

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9.5

9.1 Overview

The digital combi modules provide optically isolated in- and outputs according to IEC 6113, type 1.

The inputs detect electrical high- and low-level values through the base module connections and transmit the corresponding digital value to the gateway and the outputs receive output values from the gateway via the internal module bus. The modules convert these values and transmit the corresponding high or low level signals for each channel to the field level via the base modules.

The sensor supply (V_{sens}) and the output supply (V_O) are tapped from the internal voltage supply bus. They are short circuit proof (100 mA) and supplied be the module.

Short-circuit detection is realized in the module.

WARNING!

Automatic recovery of outputs
Active outputs
➤ Deactivate the automatic recovery of outputs via the respective parameterization

WARNING!

Faulty safety-related switching-off
Active outputs
➤ Switch-off digital outputs all-pole in galvanically isolated groups

LED displays

Channel statuses are indicated by LEDs. Error signals from the I/O level are indicated by each module via the "D" LED. The corresponding diagnostic information is transmitted to the gateway via diagnostic bits.

ATTENTION!

High voltage when switching-off inductive loads
Destruction of the electronic in the module
➤ Provide an external suppressor.

9.1.1 Module overview

Table 9-1: Module overview

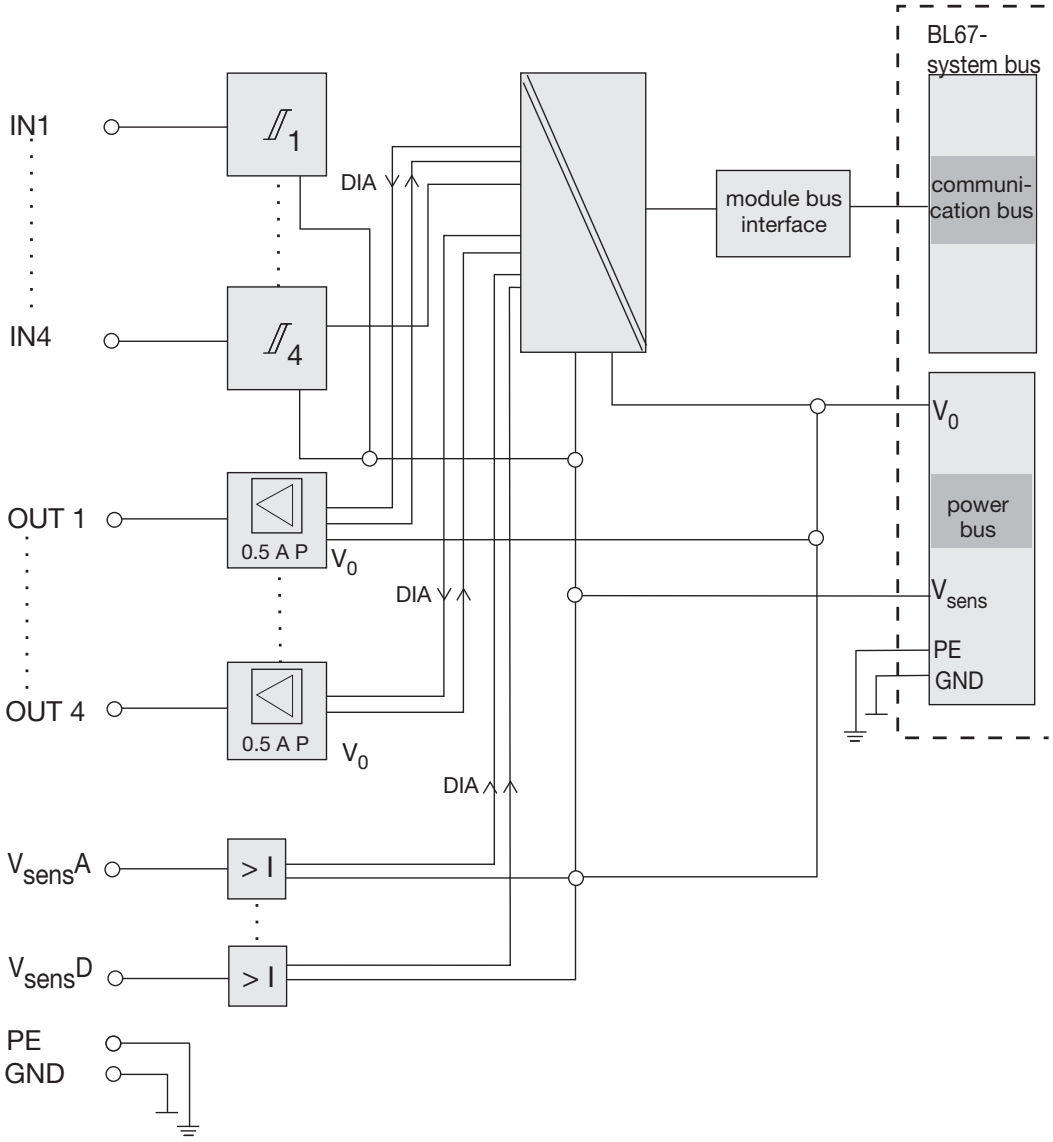
Module	No. of channels	Positive switching
BL67-4DI4DO-PD	4	✓
BL67-8XSG-PD	8	✓
BL67-8XSG-P	8	✓

9.2 BL67-4DI4DO-PD

The module provides one in- and one output at each M12-connector.

Figure 9-1:
BL67-4DI/4DO-PD

Figure 9-2:
Block diagram



9.2.1 Technical data

Table 9-2: Technical data

Designation	BL67-4DI4DO-PD
Nominal voltage from supply terminal	24 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	≤ 100 mA (at load current = 0)
Power loss of the module, typical	< 1,5 W
Inputs	4
Input voltage at nominal value 24 VDC	
– Low level	< 4,5 V
– High level	> 7 V (max. 30 V)
Input current I_{in}	
Low level	< 1,5 mA
High level	2,1 mA < I_{in} < 3,7 mA
Input delay	
T_{ON}	< 2,5 ms
T_{OFF}	< 2,5 ms
Outputs	4
Load voltage V_O	24 VDC
– Voltage range	18 to 30 VDC
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
– High level $_A$ (nominal value)	0.5 A
– High level I_{AMAX}	0.6 A (according to IEC 61 131-2)
Simultaneity factor	100 %
Switch-off characteristic K_A	
– I_{OUT} > 1.5 A	< 4 ms
– 1.0 A < I_{OUT} < 1.5 A	< 10 s
– 0.6 A < I_{OUT} < 1.0 A	min. 10 s/max. 60 s
Delay at signal change and resistive load	
– from low to high level	3 ms
– from high to low level	3 ms
Load impedance range	48 Ω to 1 kΩ

Switch-on resistance R_{on}	max. 190 mΩ
Resistive, inductive and lamp loads can be connected	
– Load impedance, resistive R_{LO}	48 Ω
– Lamp load R_{LL}	3 W
Switching frequency	
– resistive load	200 Hz
– inductive load	2 Hz
– lamp load	20 Hz
Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit proof	yes, according to EN 61 131-2

NOTE

The parallel switching of outputs is possible with the synchronous switching of the channels. In this case, the maximum output current can be increased up to 2 A, depending on the number of the parallel switched outputs.

9.2.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	-	-	-	-	DI3	DI2	DI1	DI0
Output	m	-	-	-	-	DO3	DO2	DO1	DO0

n = offset of input data; depending on extension of station and the corresponding fieldbus.

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 9-3: Process data bits

Process data	Value	Meaning
DIx	0	Digital input inactive
	1	Digital input active
DOx	0	Digital output inactive
	1	Digital output active

9.2.3 Diagnostic and status messages

LED status displays

Table 9-4: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	Red	No field voltage (LED V_I and V_O at Power Feeding module is "off")	Check the power supply for the inputs (V_{sens}) and the outputs (V_O).
	OFF	No error messages or diagnostics	-
0 to 7	Green	– LEDs 0 to 3: Input status – LEDs 4 to 7: Output status	-
	Red, flashing, 2 Hz	LED 0 to 3: Short-circuit of the Sensor supply	Eliminate the cause for the short-circuit or the overload.
	Red	LED 4 to 7: Short-circuit at output x	Eliminate the cause for the short-circuit or the overload.
	OFF	Status of the in- or output at channel x = 0	-

Diagnostic data

This module has the following diagnostic data available:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	-	-	-	-	Overcurrent sensor supply D	Overcurrent sensor supply C	Overcurrent sensor supply B	Overcurrent sensor supply A
1	-	-	-	-	Output signal overcurrent Ch3	Output signal overcurrent Ch2	Output signal overcurrent Ch1	Output signal overcurrent Ch0

Table 9-5: Diagnostics

Diagnostics	
Sensor supply overcurrent Chx	Short-circuit or overload at sensor supply A, B, C or D (see Table 9-30:)
Output signal overcurrent Chx	Short-circuit or overload at The channel is switched off automatically. For the for switching-off characteristics of the outputs see Technical data Table 9-2:.

9.2.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

Standard				**PROFIBUS PROFINET**		**Parameter**
byte-oriented		**word-oriented**				
Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Activate input filter (channel 0)
	Bit 1		Bit 1		Bit 1	Activate input filter (channel 1)
	Bit 2		Bit 2		Bit 2	Activate input filter (channel 2)
	Bit 3		Bit 3		Bit 3	Activate input filter (channel 3)
	Bit 4		Bit 4		Bit 4	reserved
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Invert digital input (channel 0)
	Bit 1		Bit 9		Bit 1	Invert digital input (channel 1)
	Bit 2		Bit 10		Bit 2	Invert digital input (channel 2)
	Bit 3		Bit 11		Bit 3	Invert digital input (channel 3)
	Bit 4		Bit 12		Bit 4	reserved
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	
Byte 2	Bit 0	Word 1	Bit 0	Byte 2	Bit 0	Manual output reset after overcurrent (channel 0)
	Bit 1		Bit 1		Bit 1	Manual output reset after overcurrent (channel 1)
	Bit 2		Bit 2		Bit 2	Manual output reset after overcurrent (channel 2)
	Bit 3		Bit 3		Bit 3	Manual output reset after overcurrent (channel 3)
	Bit 4		Bit 4		Bit 4	reserved
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	reserved
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	

Table 9-6: Module parameters

A *default setting*

Parameter name	Value	Meaning
Activate input filter	0 =no **A**	input filter: 0,25 ms
	1 = yes	input filter: 2,5 ms
Invert digital input	0 =no **A**	Input signal not inverted.
	1 = yes	Input signal inverted. conversion of the effective signal direction for sensors
Manual output reset after overcurrent	0 =no **A**	
	1 = yes	The output is manually switched-off and on again.

9.2.5 Base modules/pin assignment

- BL67-B-8M8

Figure 9-3:
BL67-B-8M8

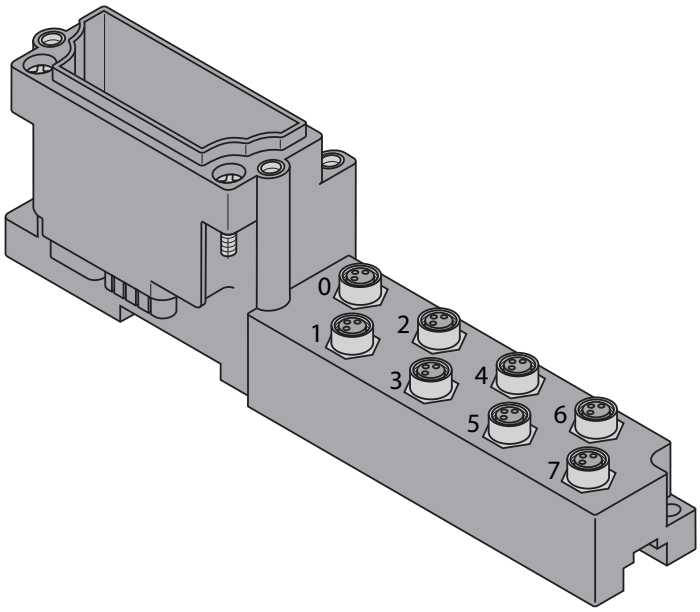


Figure 9-4:
Pin assignment
BL67-4DI4DO-PD
with BL67-B-8M8

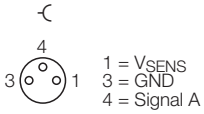
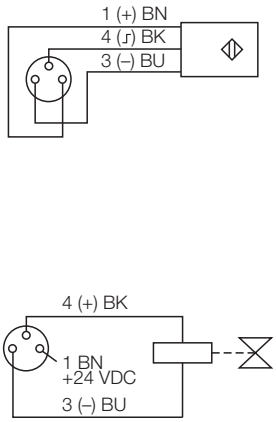


Figure 9-5:
Wiring diagram
BL67-4DI4DO-PD
with BL67-B-8M8



- BL67-B-4M12/BL67-B-4M12-P (paired)

Figure 9-6: BL67-B-4M12/ BL67-B-4M12-P

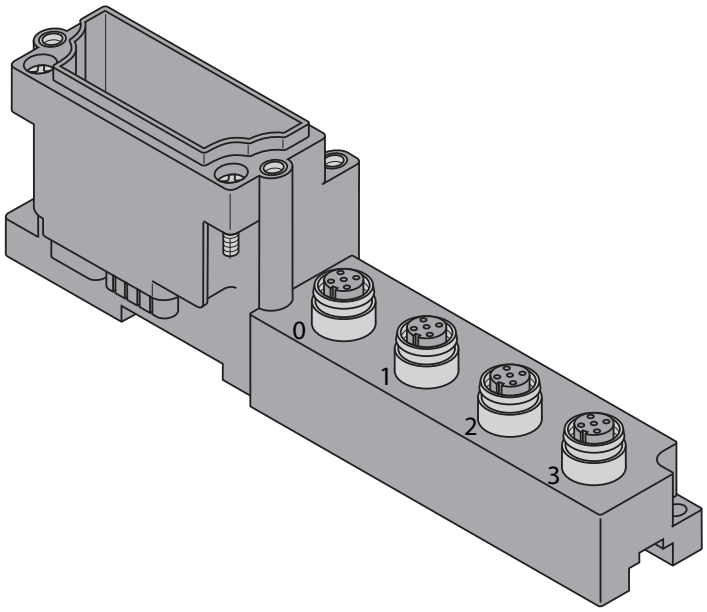


Figure 9-7: Pin assignment BL67-4DI4DO-PD with BL67-B-4M12/ BL67-B-4M12-P

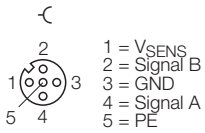


Figure 9-8: Wiring diagram BL67-4DI4DO-PD with BL67-B-4M12

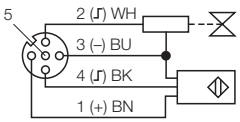
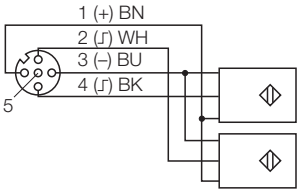
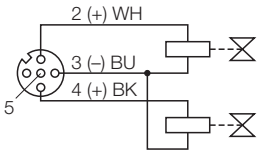


Figure 9-9: Wiring diagram BL67-4DI4DO-PD with BL67-B-4M12-P

Inputs (connector 0 and 1)



Outputs (connector 2 and 3)



- BL67-B-1M23-VI

Figure 9-10:
BL67-B-1M23-VI

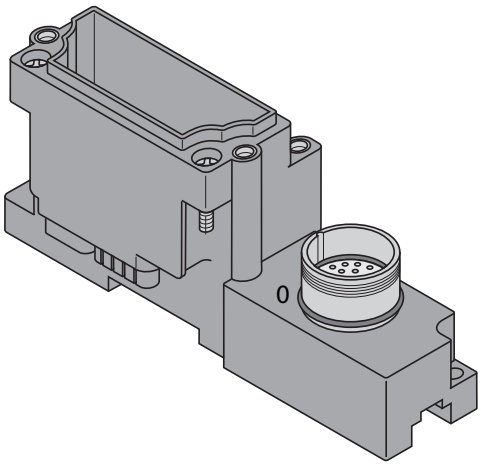


Figure 9-11:
Pin assignment
BL67-4DI4DO-PD
with
BL67-B-1M23-VI

1 = Signal 0
2 = Signal 1
3 = Signal 2
4 = Signal 3
5 = Signal 4
6 = Signal 5
7 = Signal 6
8 = Signal 7
9 = V_{SENS}
10 = V_{SENS}
11 = V_{SENS}
12 = GND

9.2.6 Signal assignment

Table 9-7: Signal assignment with BL67-B-8M8

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	-	-	-	-	C3P4	C2P4	C1P4	C0P4
Out	m	-	-	-	-	C7P4	C6P4	C5P4	C4P4

Table 9-8: Signal assignment with BL67-B-4M12

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n					C3P4	C2P4	C1P4	C0P4
Out	m					C3P2	C2P2	C1P2	C0P2

Table 9-9: Signal assignment with BL67-B-4M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n					C1P2	C1P4	C0P4	C0P4
Out	m					C3P2	C3P4	C2P4	C2P4

Table 9-10: Signal assignment with BL67-B-1M23-(VI)

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n					C0P4	C0P3	C0P2	C0P1
Out	m					C0P8	C0P7	C0P6	C0P5

n = Offset of process input data; depending on extension of station and the corresponding fieldbus.

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

C = slot no.

P = pin no.

Sensor supply

Table 9-11: Sensor supply

V_{sens}	A	B	C	D
BL67-B-8M8	C0P1/ C1P1	C2P1/ C3P1	C4P1/ C5P1	C6P1/ C7P1
BL67-B-4M12	C0P1	C1P1	C2P1	C3P1
BL67-B-4M12-P	C0P1	C1P1	C2P1	C3P1
BL67-B-1M23-VI	C0P9	C0P10	C0P11	-

9.3 BL67-8XSG-PD

The module provides 8 channels which can be configured according to application-specific needs. A maximum of 8 2-/3-wire-pnp-sensors or 8 DC-actuators can be connected to the module.

WARNING!

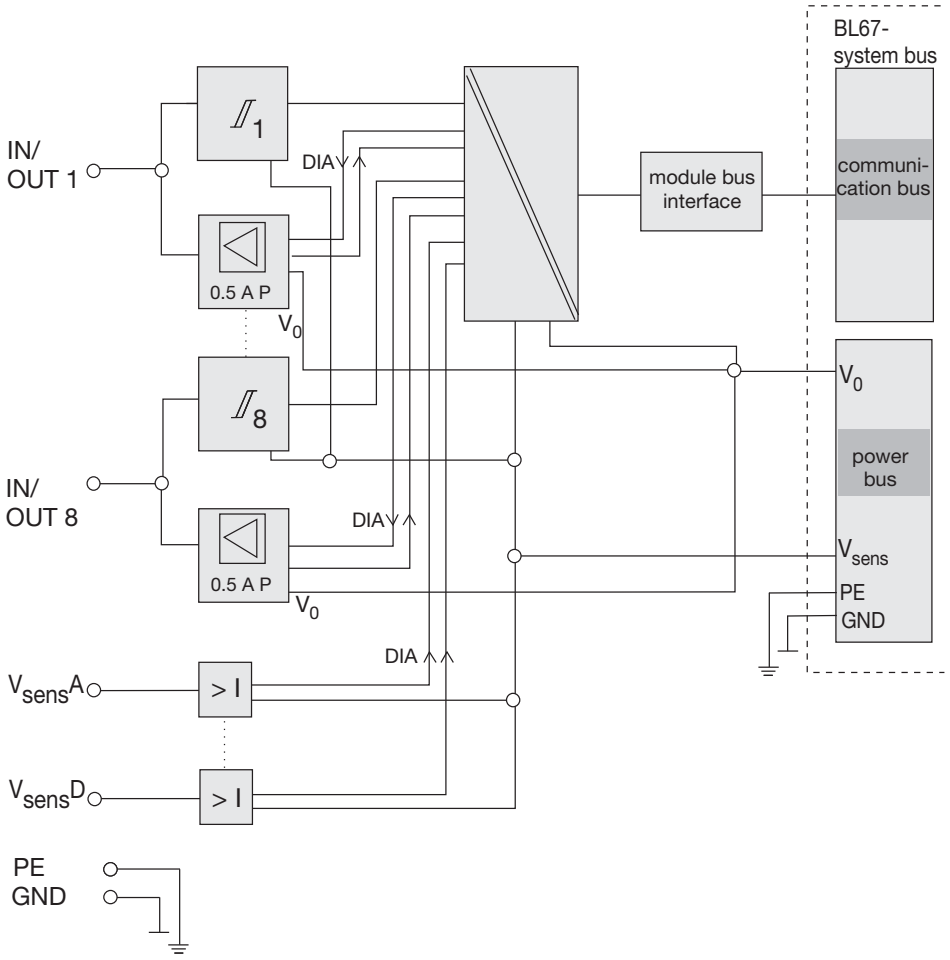
Faulty safety-related switching-off

Active outputs

➤ Switch-off V_I and V_O all-pole in galvanically isolated groups

Figure 9-12: BL67-8XSG-PD

Figure 9-13:
Block diagram



9.3.1 Technical data

Table 9-12: Technical data

Designation	BL67-8XSG-PD
Nominal voltage from supply terminal	24 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field)	≤ 100 mA (at load current = 0)
Power loss of the module, typical	< 1,5 W
Inputs	8
Input voltage V_{sens} at nominal value 24 VDC	
– Low level	< 4,5 V
– High level	> 7 V (max. 30 V)
Input current I_{in}	
Low level	< 1,5 mA
High level	2,1 mA < I_{in} < 3,7 mA
Input delay	
T_{ON}	< 2,5 ms
T_{OFF}	< 2,5 ms
Outputs	8
Load voltage V_O	24 VDC
– Voltage range	18 to 30 VDC
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
– High level $_A$ (nominal value)	0.5 A
– High level I_{AMAX}	0.6 A (according to IEC 6 1131-2)
Simultaneity factor	100 %
Switch-off characteristic K_A	
– I_{OUT} > 1.5 A	< 4 ms
– 1.0 A < I_{OUT} < 1.5 A	< 10 s
– 0.6 A < I_{OUT} < 1.0 A	min. 10 s/max. 60 s
Delay at signal change and resistive load	
– from low to high level	3 ms
– from high to low level	3 ms
– Load impedance range	48 Ω to 1 kΩ

Switch-on resistance R_{on}	max. 190 mΩ
Resistive, inductive and lamp loads can be connected.	
– Load impedance, resistive R_{LO}	48 Ω
– Lamp load R_{LL}	3 W
Switching frequency	
– resistive load	200 Hz
– inductive load	2 Hz
– lamp load	20 Hz
Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit proof	yes, according to EN 61 131-2

NOTE

The parallel switching of outputs is possible with the synchronous switching of the channels. In this case, the maximum output current can be increased up to 2 A, depending on the number of the parallel switched outputs.

9.3.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	XSG7	XSG6	XSG5	XSG4	XSG3	XSG2	XSG1	XSG0
Output	m	XSG7	XSG6	XSG5	XSG4	XSG3	XSG2	XSG1	XSG0

NOTE
The status of a digital output is simultaneously displayed as input at the respective channel.

n = Offset of process input data; depending on extension of station and the corresponding fieldbus.

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE
With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 9-13: Process data bits

Process data	Value	Meaning
DIx	0	Digital input inactive
	1	Digital input active
DOx	0	Digital output inactive
	1	Digital output active

9.3.3 Diagnostic and status messages

LED status displays

Table 9-14: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	Red	No field voltage (LED V_I and V_O at Power Feeding module is "off")	Check the power supply for the inputs (V_{sens}) and the outputs (V_O).
	OFF	No error messages or diagnostics	-
0 to 7	Green	Status of the in- or output at channel x = 1	-
	Red, flashing, 2 Hz	LED 0 to 3: Short-circuit of the Sensor supply	Eliminate the cause for the short-circuit or the overload.
	Red	LED 0 to 7: Short-circuit at output x	Eliminate the cause for the short-circuit or the overload.
	OFF	Status of the in- or output at channel x = 0	-

Diagnostic data

This module has the following diagnostic data available:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	-	-	-	-	Overcurrent sensor supply D	Overcurrent sensor supply C	Overcurrent sensor supply B	Overcurrent sensor supply A
1	-	-	-	-	Output signal overcurrent Ch3	Output signal overcurrent Ch2	Output signal overcurrent Ch1	Output signal overcurrent Ch0

Table 9-15: Diagnostics

Diagnostics	
Overcurrent sensor supply	Short-circuit or overload at sensor supply A, B, C or D (see Table 9-11:)
Output signal overcurrent	Short-circuit or overload at output x The channel is switched off automatically. For the for switching-off characteristics of the outputs see Technical data Table 9-2:.

9.3.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

Standard				PROFIBUS/ PROFINET		Parameter
byte-oriented		word-oriented				
Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Activate input filter (channel 0)
	Bit 1		Bit 1		Bit 1	Activate input filter (channel 1)
	Bit 2		Bit 2		Bit 2	Activate input filter (channel 2)
	Bit 3		Bit 3		Bit 3	Activate input filter (channel 3)
	Bit 4		Bit 4		Bit 4	Activate input filter (channel 4)
	Bit 5		Bit 5		Bit 5	Activate input filter (channel 5)
	Bit 6		Bit 6		Bit 6	Activate input filter (channel 6)
	Bit 7		Bit 7		Bit 7	Activate input filter (channel 7)
Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Invert digital input (channel 0)
	Bit 1		Bit 9		Bit 1	Invert digital input (channel 1)
	Bit 2		Bit 10		Bit 2	Invert digital input (channel 2)
	Bit 3		Bit 11		Bit 3	Invert digital input (channel 3)
	Bit 4		Bit 12		Bit 4	Invert digital input (channel 4)
	Bit 5		Bit 13		Bit 5	Invert digital input (channel 5)
	Bit 6		Bit 14		Bit 6	Invert digital input (channel 6)
	Bit 7		Bit 15		Bit 7	Invert digital input (channel 7)
Byte 2	Bit 0	Word 1	Bit 0	Byte 2	Bit 0	Manu. output reset after overcurrent (channel 0)
	Bit 1		Bit 1		Bit 1	Manu. output reset after overcurrent (channel 1)
	Bit 2		Bit 2		Bit 2	Manu. output reset after overcurrent (channel 2)
	Bit 3		Bit 3		Bit 3	Manu. output reset after overcurrent (channel 3)
	Bit 4		Bit 4		Bit 4	Manu. output reset after overcurrent (channel 4)
	Bit 5		Bit 5		Bit 5	Manu. output reset after overcurrent (channel 5)
	Bit 6		Bit 6		Bit 6	Manu. output reset after overcurrent (channel 6)
	Bit 7		Bit 7		Bit 7	Manu. output reset after overcurrent (channel 7)
Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	Activate output (channel 0)
	Bit 1		Bit 9		Bit 1	Activate output (channel 1)
	Bit 2		Bit 10		Bit 2	Activate output (channel 2)
	Bit 3		Bit 11		Bit 3	Activate output (channel 3)
	Bit 4		Bit 12		Bit 4	Activate output (channel 4)
	Bit 5		Bit 13		Bit 5	Activate output (channel 5)
	Bit 6		Bit 14		Bit 6	Activate output (channel 6)
	Bit 7		Bit 15		Bit 7	Activate output (channel 7)

Table 9-16: Module parameters

A *default setting*

Parameter name	Value	Meaning
Activate input filter	0 =no **A**	input filter: 0,25 ms
	1 = yes	input filter: 2,5 ms
Invert digital input	0 =no **A**	Input signal not inverted.
	1 = yes	Input signal inverted. conversion of the effective signal direction for sensors
Manual output reset after overcurrent	0 =no **A**	
	1 = yes	The output is manually switched-off and on again.
Activate output	0 =no **A**	
	1 = yes	

9.3.5 Base modules/pin assignment

- BL67-B-8M8

Figure 9-14: BL67-B-8M8

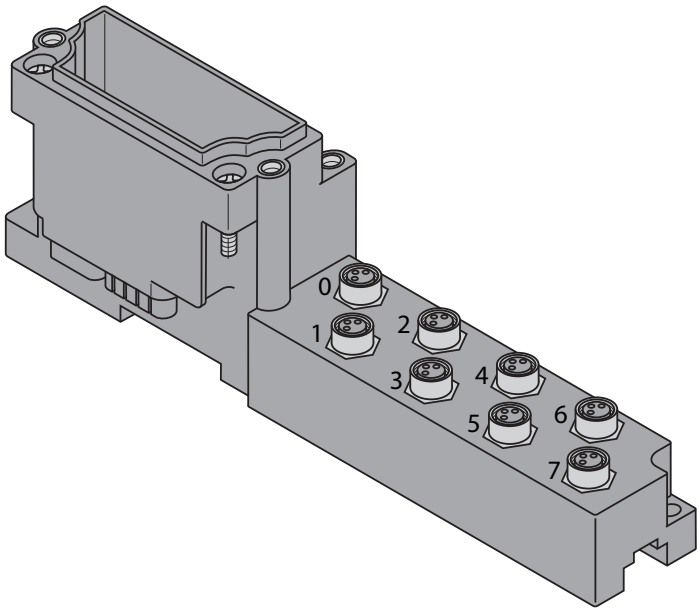


Figure 9-15: Pin assignment BL67-8XSG-PD with BL67-B-8M8

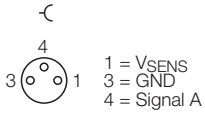
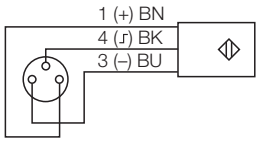
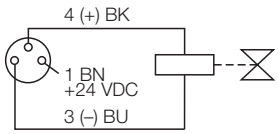


Figure 9-16: Wiring diagram BL67-8XSG-PD with BL67-B-8M8

Inputs:



Outputs:



- BL67-B-4M12/BL67-B-4M12-P (paired)

Figure 9-17: BL67-B-4M12/ BL67-B-4M12-P

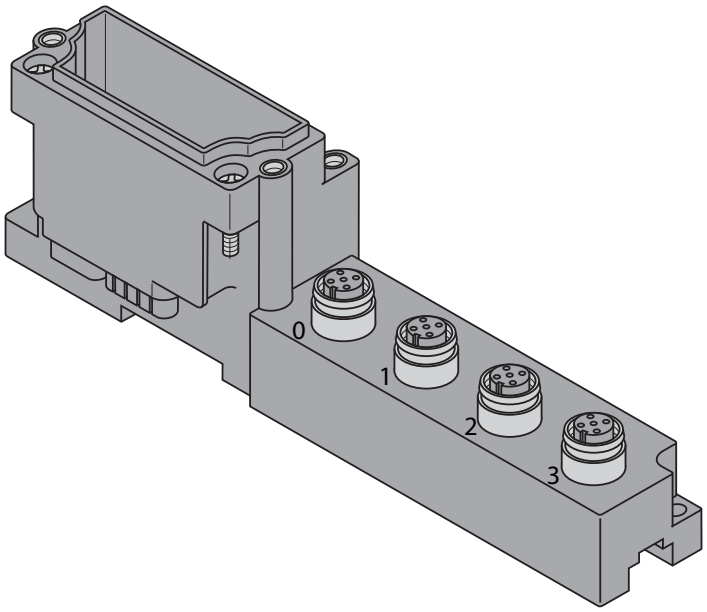


Figure 9-18: Pin assignment BL67-8XSG-PD with BL67-B-4M12/BL67-B-4M12-P

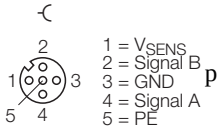
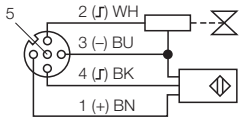
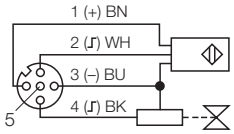
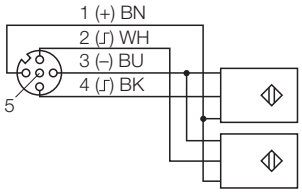


Figure 9-19: Wiring diagrams BL67-8XSG-PD with BL67-B-4M12/ BL67-B-4M12-P

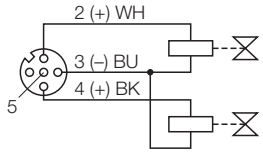




2 inputs:



2 outputs:



- BL67-B-1M23-VI
  Channel related diagnostics is not possible with this base module. The sensor supply is current limited to 4A via gateway or power feeding module.

Figure 9-20:
BL67-B-1M23-VI

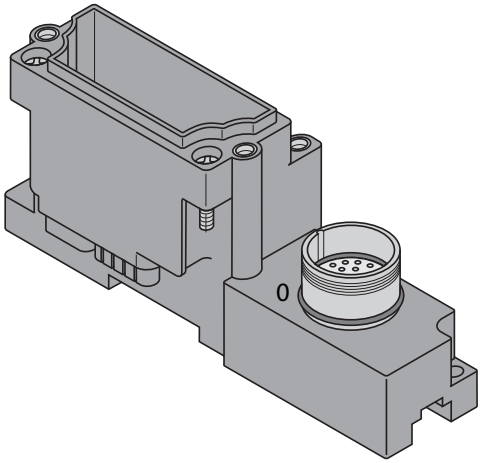


Figure 9-21:
Pin assignment
BL67-8XSG-PD
with
BL67-B-1M23-VI

1 = Signal 0
2 = Signal 1
3 = Signal 2
4 = Signal 3
5 = Signal 4
6 = Signal 5
7 = Signal 6
8 = Signal 7
9 = V_{SENS}
10 = V_{SENS}
11 = V_{SENS}
12 = GND

- BL67-B-1M23
  Channel related diagnostics is restricted with this base module. The sensor supply is electronically current limited to 3 × 100 mA (pin 9, 10, 11).

Figure 9-22:
BL67-B-1M23

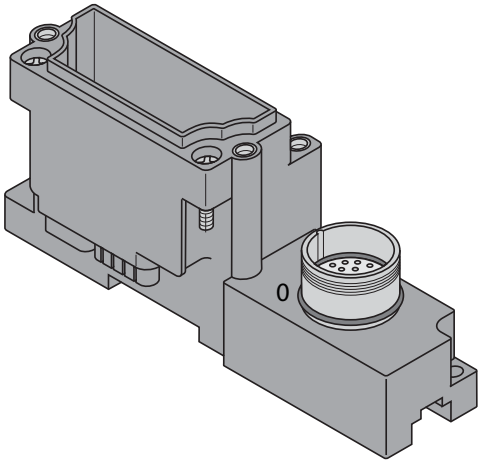
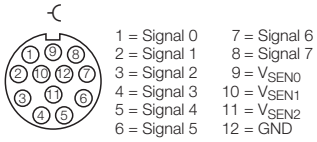


Figure 9-23:
Pin assignment
BL67-8XSG-PD
with
BL67-B-1M23



9.3.6 Signal assignment

Table 9-17: Signal assignment with BL67-B-8M8

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4
Out	m	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4

Table 9-18: Signal assignment with BL67-B-4M12

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C2P2	C1P2	C0P2	C3P4	C2P4	C1P4	C0P4
Out	m	C3P2	C2P2	C1P2	C0P2	C3P4	C2P4	C1P4	C0P4

Table 9-19: Signal assignment with BL67-B-4M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4
Out	m	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4

Table 9-20: Signal assignment with BL67-B-1M23(-VI)

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1
Out	m	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1

n = Offset of process input data; depending on extension of station and the corresponding fieldbus.

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

C = slot no.

P = pin no.

9.3.7 Sensor supply

Table 9-21: Sensor supply

V_{sens}	A	B	C	D
BL67-B-8M8	C0P1/ C1P1	C2P1/ C3P1	C4P1/ C5P1	C6P1/ C7P1
BL67-B-4M12	C0P1	C1P1	C2P1	C3P1
BL67-B-4M12-P	C0P1	C1P1	C2P1	C3P1
BL67-B-1M23(-VI)	C0P9	C0P10	C0P11	-

9.4 BL67-8XSG-P

The module provides 8 channels which can be configured according to application-specific needs. A maximum of 8 2-/3-wire-pnp-sensors or 8 DC-actuators can be connected to the module.

WARNING!

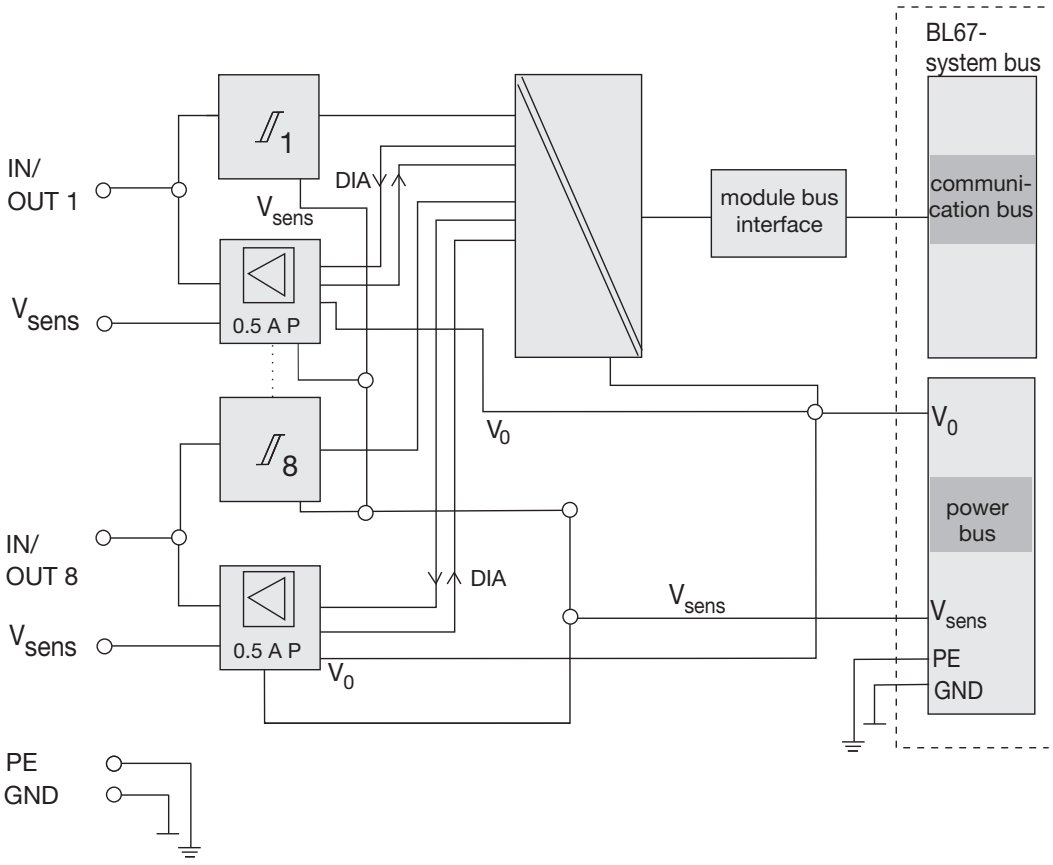
Faulty safety-related switching-off

Active outputs

➤ Switch-off V_I and V_O all-pole in galvanically isolated groups

Figure 9-24: BL67-8XSG-P

Figure 9-25: Block diagram



9.4.1 Technical data

Table 9-22: Technical data

Designation	BL67-8XSG-P
Nominal voltage from supply terminal	24 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field)	≤ 100 mA (at load current = 0)
Power loss of the module, typical	< 1,5 W
Inputs	8
Input voltage V_{sens} at nominal value 24 VDC	
– Low level	< 4,5 V
– High level	> 7 V (max. 30 V)
Input current I_{in}	
Low level	< 1,5 mA
High level	2,1 mA < I_{in} < 3,7 mA
Input delay	
T_{ON}	< 2,5 ms
T_{OFF}	< 2,5 ms
Outputs	8
Load voltage V_O	24 VDC
– Voltage range	18 to 30 VDC
Output voltage, high level (loaded)	min. L+ (-1 V)
Output current I_A	
– High level $_A$ (nominal value)	0.5 A
– High level I_{AMAX}	0.6 A (according to IEC 61131-2)
Simultaneity factor	100 %
Switch-off characteristic K_A	
– I_{OUT} > 1.5 A	< 4 ms
– 1.0 A < I_{OUT} < 1.5 A	< 10 s
– 0.6 A < I_{OUT} < 1.0 A	min. 10 s/max. 60 s
Delay at signal change and resistive load	
– from low to high level	3 ms
– from high to low level	3 ms
– Load impedance range	48 Ω to 1 kΩ

Switch-on resistance R_{on}	max. 190 mΩ
Resistive, inductive and lamp loads can be connected.	
– Load impedance, resistive R_{LO}	48 Ω
– Lamp load R_{LL}	3 W
Switching frequency	
– resistive load	200 Hz
– inductive load	2 Hz
– lamp load	20 Hz
Isolation voltage	
U_{TMB} (module bus/field)	max. 2500 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
Short-circuit proof	yes, according to EN 61 131-2

NOTE

The parallel switching of outputs is possible with the synchronous switching of the channels. In this case, the maximum output current can be increased up to 2 A, depending on the number of the parallel switched outputs.

9.4.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	XSG7	XSG6	XSG5	XSG4	XSG3	XSG2	XSG1	XSG0
Output	m	XSG7	XSG6	XSG5	XSG4	XSG3	XSG2	XSG1	XSG0

NOTE

The status of a digital output is simultaneously displayed as input at the respective channel.

n = Offset of process input data; depending on extension of station and the corresponding fieldbus.

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 9-23: Process data bits

Process data	Value	Meaning
DIx	0	Digital input inactive
	1	Digital input active
DOx	0	Digital output inactive
	1	Digital output active

9.4.3 Diagnostic and status messages

LED status displays

Table 9-24: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	Red	No field voltage (LED V_I and V_O at Power Feeding module is "off")	Check the power supply for the inputs (V_{sens}) and the outputs (V_O).
	OFF	No error messages or diagnostics	-
0 to 7	Green	Status of the in- or output at channel x = 1	-
	Red	LED 0 to 7: Short-circuit at output x	Eliminate the cause for the short-circuit or the overload.
	OFF	Status of the in- or output at channel x = 0	-

Diagnostic data

This module provides no diagnostic data.

9.4.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

Standard byte-oriented		Standard word-oriented		PROFIBUS/ PROFINET		Parameter
Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Activate input filter (channel 0)
	Bit 1		Bit 1		Bit 1	Activate input filter (channel 1)
	Bit 2		Bit 2		Bit 2	Activate input filter (channel 2)
	Bit 3		Bit 3		Bit 3	Activate input filter (channel 3)
	Bit 4		Bit 4		Bit 4	Activate input filter (channel 4)
	Bit 5		Bit 5		Bit 5	Activate input filter (channel 5)
	Bit 6		Bit 6		Bit 6	Activate input filter (channel 6)
	Bit 7		Bit 7		Bit 7	Activate input filter (channel 7)
Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Invert digital input (channel 0)
	Bit 1		Bit 9		Bit 1	Invert digital input (channel 1)
	Bit 2		Bit 10		Bit 2	Invert digital input (channel 2)
	Bit 3		Bit 11		Bit 3	Invert digital input (channel 3)
	Bit 4		Bit 12		Bit 4	Invert digital input (channel 4)
	Bit 5		Bit 13		Bit 5	Invert digital input (channel 5)
	Bit 6		Bit 14		Bit 6	Invert digital input (channel 6)
	Bit 7		Bit 15		Bit 7	Invert digital input (channel 7)
Byte 2	Bit 0	Word 1	Bit 0	Byte 2	Bit 0	Manu. output reset after overcurrent (channel 0)
	Bit 1		Bit 1		Bit 1	Manu. output reset after overcurrent (channel 1)
	Bit 2		Bit 2		Bit 2	Manu. output reset after overcurrent (channel 2)
	Bit 3		Bit 3		Bit 3	Manu. output reset after overcurrent (channel 3)
	Bit 4		Bit 4		Bit 4	Manu. output reset after overcurrent (channel 4)
	Bit 5		Bit 5		Bit 5	Manu. output reset after overcurrent (channel 5)
	Bit 6		Bit 6		Bit 6	Manu. output reset after overcurrent (channel 6)
	Bit 7		Bit 7		Bit 7	Manu. output reset after overcurrent (channel 7)
Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	Activate output (channel 0)
	Bit 1		Bit 9		Bit 1	Activate output (channel 1)
	Bit 2		Bit 10		Bit 2	Activate output (channel 2)
	Bit 3		Bit 11		Bit 3	Activate output (channel 3)
	Bit 4		Bit 12		Bit 4	Activate output (channel 4)
	Bit 5		Bit 13		Bit 5	Activate output (channel 5)
	Bit 6		Bit 14		Bit 6	Activate output (channel 6)
	Bit 7		Bit 15		Bit 7	Activate output (channel 7)

Table 9-25: Module parameters

A *default setting*

Parameter name	Value	Meaning
Activate input filter	0 =no **A**	input filter: 0,25 ms
	1 = yes	input filter: 2,5 ms
Invert digital input	0 =no **A**	Input signal not inverted.
	1 = yes	Input signal inverted. conversion of the effective signal direction for sensors
Manual output reset after overcurrent	0 =no **A**	
	1 = yes	The output is manually switched-off and on again.
Activate output	0 =no **A**	
	1 = yes	

9.4.5 Base modules/pin assignment

- BL67-B-8M8

Figure 9-26: BL67-B-8M8

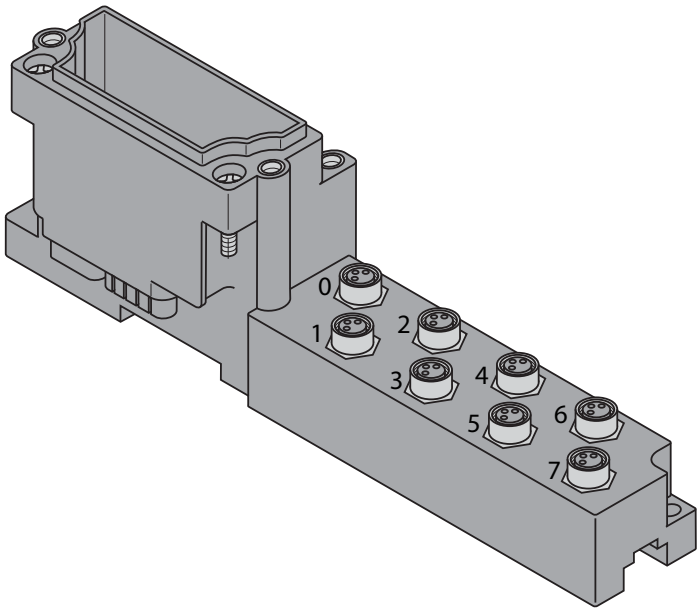


Figure 9-27: Pin assignment BL67-8XSG-P with BL67-B-8M8

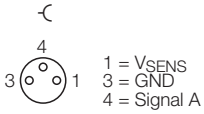
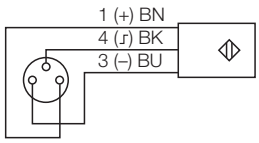
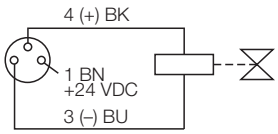


Figure 9-28: Wiring diagram BL67-8XSG-P with BL67-B-8M8

Inputs:



Outputs:



- BL67-B-4M12/BL67-B-4M12-P (paired)

Figure 9-29:
BL67-B-4M12/
BL67-B-4M12-P

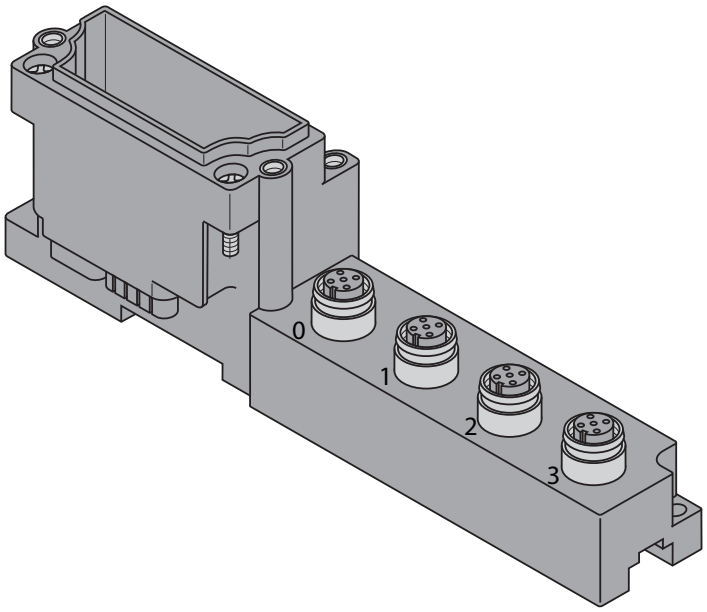


Figure 9-30:
Pin assignment
BL67-8XSG-P with
BL67-B-4M12/
BL67-B-4M12-P

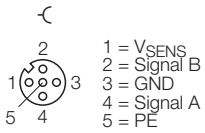
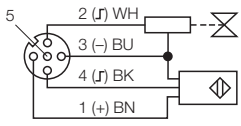
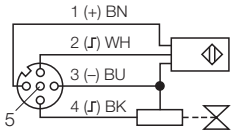
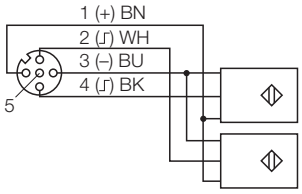


Figure 9-31:
Wiring diagram
BL67-8XSG-P with
BL67-B-4M12/
BL67-B-4M12-P

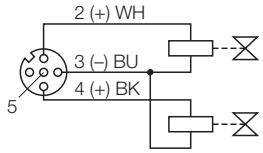




2 inputs:



2 outputs:



- BL67-B-1M23
  The sensor supply is electronically current limited to 3 × 100 mA (pin 9, 10, 11).

Figure 9-32:
BL67-B-1M23

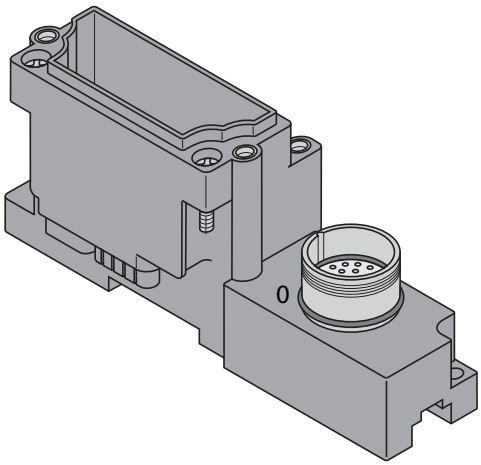


Figure 9-33:
Pin assignment
BL67-8XSG-P with
BL67-B-1M23

1 = Signal 0
2 = Signal 1
3 = Signal 2
4 = Signal 3
5 = Signal 4
6 = Signal 5
7 = Signal 6
8 = Signal 7
9 = V_{SEN0}
10 = V_{SEN1}
11 = V_{SEN2}
12 = GND

9.4.6 Signal assignment

Table 9-26: Signal assignment with BL67-B-8M8

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4
Out	m	C7P4	C6P4	C5P4	C4P4	C3P4	C2P4	C1P4	C0P4

Table 9-27: Signal assignment with BL67-B-4M12

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C2P2	C1P2	C0P2	C3P4	C2P4	C1P4	C0P4
Out	m	C3P2	C2P2	C1P2	C0P2	C3P4	C2P4	C1P4	C0P4

Table 9-28: Signal assignment with BL67-B-4M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4
Out	m	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4

Table 9-29: Signal assignment with BL67-B-1M23

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
In	n	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1
Out	m	C0P8	C0P7	C0P6	C0P5	C0P4	C0P3	C0P2	C0P1

n = Offset of process input data; depending on extension of station and the corresponding fieldbus.

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

C = slot no.

P = pin no.

9.4.7 Sensor supply

Table 9-30: Sensor supply

V_{sens}	A	B	C	D
BL67-B-8M8	C0P1/ C1P1	C2P1/ C3P1	C4P1/ C5P1	C6P1/ C7P1
BL67-B-4M12	C0P1	C1P1	C2P1	C3P1
BL67-B-4M12-P	C0P1	C1P1	C2P1	C3P1
BL67-B-1M23	C0P9	C0P10	C0P11	-

10 Analog combi modules

10.1 BL67-4AI4AO-VI, voltage/current 2

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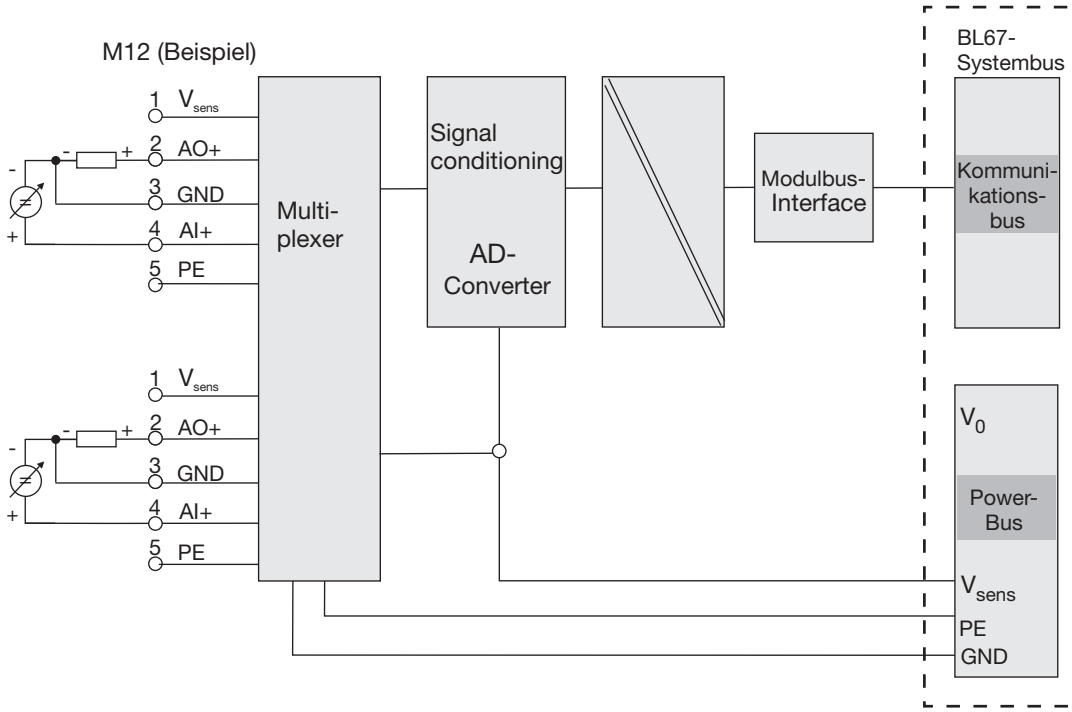
10.1 BL67-4AI4AO-VI, voltage/current

Figure 10-1:
BL67-4AI4AO-V/I

Figure 10-2:
Block diagram



10.1.1 Technical data

Table 10-1: Technical data

Designation	BL67-4AI4AO-V/I
No. of channels	4/4
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 50 mA
Nominal current from supply terminal (field) I_L	≤ 50 mA
Power loss of the module, typical P_{MAX}	< 1 W
I_{SENS} (actuator supply V_O)	≤ 4 A electronic short-circuit protection in Power Feeding module or gateway
Input signal in current measurement	
Input resistance (burden)	< 125 Ω (typ. 65 Ω)
Input current (range which can be evaluated by the A/D converter)	0 to 20 mA 4 to 20 mA
Input current (maximum - an "Measured value out of range" is shown if the current is above 20.2 mA)	50 mA
Cutoff frequency (-3 dB)	20 Hz
Input signal in voltage measurement	
Input resistance (burden)	> 98,5 kΩ (typ. 225 kΩ)
Input voltage (range which can be evaluated by the A/D converter)	-10 to 10 VDC 0 to 10 VDC
Input voltage (maximum - a deviation of 1 % already generates a "Measured value out of range" message)	35 VDC
Cutoff frequency (-3 dB)	20 Hz
accuracy of the input signal	
Basic error at 23 °C/73.4 °F	< 0.3 %
Temperature coefficient	≤ 300 ppm/°C from end value
Measurement time/conversion time	4,5 ms
Output signal in voltage measurement	
Output delay (all channels parallel)	< 3 ms
Output voltage U_A	-10/0 to 10 VDC
Burden resistance	
– Resistive load R_{LO}	> 1 kΩ

– Capacitive load R_{Lk}	< 1 µF
Short-circuit current I_K	≤ 40 mA
Transmission frequency f_T	< 100 Hz
Basic error at 23 °C/73.4 °F	0.3 %
Repeat accuracy	0,05 %
Output ripple	0.02 %
Temperature coefficient	≤ 300 ppm/°C from end value
Settling time (maximum)	
– Resistive load	max. 0,5 ms
– Inductive load	max. 2,0 ms
– Capacitive load	max. 2,0 ms
Common mode error	min. 90 dB
Differential mode error	min. 70 dB
Crosstalk suppression	min. - 50 dB
Isolation voltages	
U_{TMB} (module bus/field)	min. 500 VDC
U_{PE} (field/PE)	min. 500 VDC
Resolution of the A/D converter	16 bit
Measuring principle	Delta-Sigma

10.1.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	AI0 LSB							
	n + 1	AI0 MSB							
	n + 2	AI1 LSB							
	n + 3	AI1 MSB							
	n + 4	AI2 LSB							
	n + 5	AI2 MSB							
	n + 6	AI3 LSB							
	n + 7	AI3 MSB							
Output	m	AO0 LSB							
	m + 1	AO0 MSB							
	m + 2	AO1 LSB							
	m + 3	AO1 LSB							
	m +4	AO2 LSB							
	m + 5	AO2 MSB							
	m + 6	AO3 LSB							
	m + 7	AO3 MSB							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 10-2: Process data bits

Process data	Meaning
AI1 LSB	low byte of the analog value
AIx MSB	high byte of the analog value
AOx LSB	low byte of the analog value
AOx LSB	high byte of the analog value

10.1.3 Diagnostic and status messages

LED status displays

Table 10-3: LED status displays

LED	Display	Meaning	Remedy
D	red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–
0 to 4	Green	Input channel x active	-
	Green flashing, 0.5 Hz	Underflow diagnostic at input	-
	Green, flashing, 4 Hz	Overflow diagnostic at input	-
	OFF	Input channel x inactive	

Diagnostic data

This module has the following diagnostic data available **per channel**:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Hardware failure	-	-	-	Overflow/ underflow	-	Wire break	Measured value/ output value out of range

Table 10-4: Diagnostics

Diagnostics	Meaning
Measured value out of range	Indicates an over- or undercurrent of 1 % of the set current range; whereby, undercurrents can only be recognized with those modules that have a set current range of 4 to 20 mA.
Output value out of range	Underrun/overrun of the valid output range (limit values see page 10-27ff.)
Wire break (only 4-20 mA)	Displays a wire break in the signal line for the operating mode 4 to 20 mA. (I < 3 m)
Overflow/underflow (NE 43 only)	The output value lies under or over the set output value and can not be given out (limit values see page 10-27)
Hardware failure	Shows common errors of the module hardware (e.g. CRC-error, calibration error, …). The return analog value in case of an error is "0". Module exchange necessary!

NOTE

In the 12-bit-representation (left-justified) the diagnostic data are transmitted with the lower nibble of the process data for the respective channel.

10.1.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS/ PROFINET		Parameter
	byte-oriented		word-oriented				
Input 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Operation mode
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	Data format
		Bit 5		Bit 5		Bit 5	Deactivate diagnostics
		Bit 6		Bit 6		Bit 6	reserved
		Bit 7		Bit 7		Bit 7	
Output 0	Byte 1	Bit 0		Bit 8	Byte 2	Bit 0	Operation mode
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	Data format
		Bit 5		Bit 13		Bit 5	Deactivate diagnostics
		Bit 6		Bit 14		Bit 6	Output on module bus error
		Bit 7		Bit 15		Bit 7	
	Byte 2	Bit 0	Word 1	Bit 0	Byte 1	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

	Standard				PROFIBUS/ PROFINET		Parameter
	byte-oriented		word-oriented				
Input 1	Byte 4	Bit 0	Word 2	Bit 0	Byte 5	Bit 0	Operation mode
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	Data format
		Bit 5		Bit 5		Bit 5	Deactivate diagnostics
		Bit 6		Bit 6		Bit 6	reserved
		Bit 7		Bit 7		Bit 7	
Output 1	Byte 5	Bit 0		Bit 8	Byte 4	Bit 0	Operation mode
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	Data format
		Bit 5		Bit 13		Bit 5	Deactivate diagnostics
		Bit 6		Bit 14		Bit 6	Output on module bus error
		Bit 7		Bit 15		Bit 7	
	Byte 6	Bit 0	Word 3	Bit 0	Byte 6	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 7	Bit 0		Bit 8	Byte 8	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
Input 2	Byte 8	Bit 0	Word 4	Bit 0	Byte 7	Bit 0	Operation mode
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	Data format
		Bit 5		Bit 5		Bit 5	Deactivate diagnostics
		Bit 6		Bit 6		Bit 6	reserved
		Bit 7		Bit 7		Bit 7	

	Standard				PROFIBUS/ PROFINET		Parameter
	byte-oriented		word-oriented				
Output 2	Byte 9	Bit 0	Word 4	Bit 8	Byte 9	Bit 0	Operation mode
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	Data format
		Bit 5		Bit 13		Bit 5	Deactivate diagnostics
		Bit 6		Bit 14		Bit 6	Output on module bus error
		Bit 7		Bit 15		Bit 7	
	Byte 10	Bit 0	Word 5	Bit 0	Byte 11	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 11	Bit 0		Bit 8	Byte 10	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
Input 3	Byte 12	Bit 0	Word 6	Bit 0	Byte 12	Bit 0	Operation mode
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	Data format
		Bit 5		Bit 5		Bit 5	Deactivate diagnostics
		Bit 6		Bit 6		Bit 6	reserved
		Bit 7		Bit 7		Bit 7	
Output 3	Byte 13	Bit 0		Bit 8	Byte 13	Bit 0	Operation mode
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	Data format
		Bit 5		Bit 13		Bit 5	Deactivate diagnostics
		Bit 6		Bit 14		Bit 6	Output on module bus error
		Bit 7		Bit 15		Bit 7	
	Byte 14	Bit 0	Word 7	Bit 0	Byte 15	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	

	Standard				PROFIBUS/ PROFINET		Parameter
	byte-oriented		word-oriented				
Output 3	Byte 15	Bit 0	Word 7	Bit 8	Byte 14	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

NOTE

Concerning the "number representation", please observe the tables for measurement value representation on the following pages.

Table 11: Module parameters

A *default settings*
B *for in- and outputs*
C *only for inputs*

Parameter	**settings**
Operation mode	0000 = voltage, -10 … 10 VDC standard **A, B** 0001 = voltage, 0 … 10 VDC standard **B** 0010 = voltage, -10 … 10 VDC PA (NE 43) **B** 0011 = voltage, 0 … 10 VDC PA (NE 43) **B** 0100 = voltage, -10 … 10 VDC ext. range **B** 0101 = voltage, 0 … 10 VDC ext. range **B** 0110 = reserved 0111 = reserved 1000 = 0 … 20 mA standard **A, C** 1001 = 4 … 20 mA standard **C** 1010 = 0 … 20 mA PA (NE 43) **C** 1011 = 4 … 20 mA PA (NE 43) **C** 1100 = 0 … 20 mA ext. range **C** 1101 = 4 … 20 mA ext. range **C** 1111 = deactivate
Data format	0 = 15 bit + sign **A** 1 = 12 bit (left-justified)
Deactivate diagnostics	0 =no **A** 1 = yes
Output on module bus error	0 = substitute value **A** 1 = current value
Substitute value Ax	Substitute value = "0" **A** 1. The substitute value defined here will be sent in consequence of certain events parameterized in the gateway. or 2. In case of a module bus error: The substitute value defined here will be sent if the parameter "Behavior module bus error Ax" is set to "output substitute value".

10.1.5 Measurement value representation of the inputs

Standard value representation

- 16-bit-representation

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 3,052 × 10^{-4}) V				
> 10.1000 V		at ↑ DIA Measured value out of range ON	32767	7FFF
≤ 10.0500 V		at ↓ DIA Measured value out of range OFF	32767	7FFF
10.0000 V	nominal range		32767	7FFF
9.9997 V			32766	7FFE
...			...	...
5.0002 V			16384	4000
...			...	...
0.000305 V			1	0001
0.000000 V			0	0000
-0.000305 V			-1	FFFF
...			...	...
-5.0000 V			-16384	C000
...			...	...
-9.9997 V			-32767	8001
≤ -10.0000 V			-32768	8000
≥ -10,0500 V		at ↑ DIA Measured value out of range OFF	-32768	8000
< -10,1000 V		at ↓ DIA Measured value out of range ON	-32768	8000

0 ... 10 V	unipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 3,052 × 10^{-4}) V				
> 10.1000 V		at ↑ DIA Measured value out of range ON	32767	7FFF
≤ 10.0500 V		at ↓ DIA Measured value out of range OFF	32767	7FFF
10.0000 V	nominal range		32767	7FFF
9.9997 V			32766	7FFE
...			...	...
5.0002 V			16384	4000
...			...	...
0.000305 V			1	0001
≤ 0.000000 V			0	0000
≥ -0,0500 V		at ↑ DIA Measured value out of range OFF	0	0000
< -0,1000 V		at ↓ DIA Measured value out of range ON	0	0000

0 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 6,104 × 10^{-4}) mA				
> 20.2000 mA		at ↑ DIA Measured value out of range ON	32767	7FFF
≤ 20.1000 mA		at ↓ DIA Measured value out of range OFF	32767	7FFF
20.0000 mA	nominal range		32767	7FFF
19.9994 mA			32766	7FFE
...			...	...
10.0003 mA			16384	4000
...			...	...
0.0006104 mA			1	0001
≤ 0.0000 mA			0	0000
≥ -0.1 mA		at ↑ DIA Measured value out of range OFF	0	0000
< -0,2 mA		at ↓ DIA Measured value out of range ON	0	0000

4 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 4,883 × 10^{-4}) + 4) mA				
> 20.2000 mA		at ↑ DIA Measured value out of range ON	32767	7FFF
≤ 20.1000 mA		at ↓ DIA Measured value out of range OFF	32767	7FFF
20.0000 mA	nominal range		32767	7FFF
19.9995 mA			32766	7FFE
...			...	...
12.00024 mA			16384	4000
...			...	...
4.0004883 mA			1	0001
≤ 4.0000 mA			0	0000
≥ 3,7000 mA		at ↑ DIA Measured value out of range OFF	0	0000
< 3.6000 mA		at ↓ DIA Measured value out of range ON	0	0000
≥ 3,0000 mA		at ↑ DIA Wire break OFF	0	0000
< 2.9000 mA		at ↓ DIA Wire break ON	0	0000

- 12-bit-representation (left-justified)

NOTE

If the measurement value representation is parameterized as "12 bit left-justified" the diagnostic data will be transferred with the process data bits 0 to 3 of the respective channel.

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value/16 × 4,885 × 10^{-3}) V				
> 10.1000 V		at ↑ DIA Measured value out of range ON	2047 × 16	7FFF
≤ 10.0500 V		at ↓ DIA Measured value out of range OFF	2047 × 16	7FFF
10.0000 V	nominal range		2047 × 16	7FFF
9.9951 V			2046 × 16	7FE×
…			…	…
5.00244 V			1024 × 16	400×
…			…	…
0.00488 V			1 × 16	001×
0.000000 V			0	000×
-0.000488 V			-1 × 16	FFF×
…			…	…
-5.0000 V			-1024 × 16	C00×
…			…	…
-9.99511 V			-2047 × 16	801×
≤ -10.0000 V			-2048 × 16	800×
≥ -10,0500 V		at ↑ DIA Measured value out of range OFF	-2048 × 16	800×
< -10,1000 V		at ↓ DIA Measured value out of range ON	-2048 × 16	800×

0 ... 10 V	unipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value/16 × 2,442 × 10^{-3}) V				
> 10.1000 V		at ↑ DIA Measured value out of range ON	4095 × 16	FFF×
≤ 10.0500 V		at ↓ DIA Measured value out of range OFF	4095 × 16	FFF×
10.0000 V	nominal range		4095 × 16	FFF×
9.9976 V			4094 × 16	FFE×
…			…	…
5.0012 V			2048 × 16	800×
…			…	…
0.00244 V			1 × 16	001×
≤ 0.0000 V			0	000×
≥ -0,0500 V		at ↑ DIA Measured value out of range OFF	0	000×
< -0,1000 V		at ↓ DIA Measured value out of range ON	0	000×

0 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value U_M = (dec. value/16 × 4,884 × 10^{-3}) mA				
> 20.2000 mA		at ↑ DIA Measured value out of range ON	4095 × 16	FFF×
≤ 20.1000 mA		at ↓ DIA Measured value out of range OFF	4095 × 16	FFF×
≥ 20.0000 mA	nominal range		4095 × 16	FFF×
19.9951 mA			4094 × 16	FFE×
…			…	…
10.0024 mA			2048 × 16	800×
…			…	…
0.00488 mA			1 × 16	001×
≤ 0,0000 mA			0	000×
≥ -0.1 mA	under-drive	at ↑ DIA Measured value out of range OFF	0	000×
< -0,2 mA		at ↓ DIA Measured value out of range ON	0	000×

4 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value/16 × 3,907 × 10^{-3}) + 4) mA				
> 20.2000 mA		at ↑ DIA Measured value out of range ON	4095 × 16	FFF×
≤ 20.1000 mA		at ↓ DIA Measured value out of range OFF	4095 × 16	FFF×
≥ 20.0000 mA	nominal range		4095 × 16	FFF×
19.9961 mA			4094 × 16	FFE×
…			…	…
12.0020 mA			2048 × 16	800×
…			…	…
4.0039 mA			1 × 16	001×
≤ 4.0000 mA			0	000×
≥ 3,7000 mA		at ↑ DIA Measured value out of range OFF	0	000×
< 3,6000 mA		at ↓ DIA Measured value out of range ON	0	000×
≥ 3,0000 mA		at ↑ DIA Wire break OFF	0	000×
< 2,9000 mA		at ↓ DIA Wire break ON	0	000×

Extended range - value representation

- 16-bit-representation

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 3,617 × 10^{-4}) V				
≥ 11.851490 V	overflow		32767	7FFF
≥ 11.7588V		at ↑ DIA Measured value out of range ON	32512	7F00
11.7584 V	over-drive		32511	7EFF
≤ 11.603010 V		at ↓ DIA Measured value out of range OFF	32080	7D50
10.000305 V			27649	6C01
10.000000 V	nominal range		27648	6C00
...			...	...
5.0000 V			13824	3600
...			...	...
0.0003617 V			1	0001
0.000000 V			0	0000
-0.0003617 V			-1	FFFF
...			...	...
-5.000000 V			-13824	CA00
...			...	...
-10.000000V			-27648	9400
-10.000362 V	under-drive		-27649	93FF
≥ -11,60301 V		at ↑ DIA Measured value out of range OFF	-32080	82B0
-11.758897 V			-32511	8100
-11.759259 V	underflow	at ↓ DIA Measured value out of range ON	-32512	80FF
≤ -11.851851 V			-32768	8000

0 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 3,617 × 10^{-4}) V				
≥ 11.851 V	overflow		32767	7FFF
≥ 11.7588 V		at ↑ DIA Measured value out of range ON	32512	7F00
11.7584 V	under-drive		32511	7EFF
≤ 11.603010 V		at ↓ DIA Measured value out of range OFF	32080	7D50
10.000305 V			27649	6C01
10.000000 V	nominal range		27648	6C00
...			...	...
5.0000 V			13824	3600
...			...	...
0.000361 V			1	0001
0.000000 V			0	0000
< 0,000000 V			0	0000
≥ -0,050 V	underflow	at ↑ DIA Overflow/underflow OFF	0	0000
< -0,100 V		at ↓ DIA Overflow/underflow ON	0	0000

0 ... 20 mA	bipolar	Diagnostics	dec.	hex.
current $value_M$ = (dec. value × 7,234 × 10^{-4}) mA				
≥ 23.70298 mA	overflow		32767	7FFF
≥ 23.51852 mA		at ↑ DIA Measured value out of range ON	32512	7F00
23.517795 mA	over-drive		32511	7EFF
≤ 23.2060 mA		at ↓ DIA Measured value out of range OFF	32080	7D50
20.000723 mA			27649	6C01
20.000000 mA	nominal range		27648	6C00
...			...	...
10.0000 mA			13824	3600
...			...	...
0.0007234 mA			1	0001
0.000000 mA			0	0000
≥ -0.1 mA	under-flow	at ↑ DIA Overflow/underflow OFF	0	000×
< -0,2 mA		at ↓ DIA Overflow/underflow ON	0	000×

4 ... 20 mA	bipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 5,787 × 10^{-4}) mA				
≥ 22.96238 mA	overflow		32767	7FFF
≥ 22.81481 mA		at ↑ DIA Measured value out of range ON	32512	7F00
22.814236 mA	over-drive		32511	7EFF
≤ 22.56482 mA		at ↓ DIA Measured value out of range OFF	32080	7D50
20.000579 mA			27649	6C01
20.000000 mA	nominal range		27648	6C00
...			...	...
12.0000 mA			13824	3600
...			...	...
4.0005787 mA			1	0001
4.000000 mA			0	0000
3.999421 mA	under-drive		-1	FFFF
≥ 1.5567 mA		at ↑ DIA Measured value out of range OFF	-4222	EEBA
1.185185			-4864	ED00
≤ 1.184606 mA	underflow	at ↓ DIA Measured value out of range ON	-4865	ECFF
≤ 0.0000 mA			-6912	E500

- 12-bit-representation (left-justified)

The representation of the 12 bit values corresponds to that of the 16 bit values. Only bits 0 to 3 are set to "0". Diagnostic data are not mapped to the process data.

-10 ... 10 V	**bipolar**	**Diagnostics**	**dec.**	**hex.**
voltage value U_M = (dec. value/16 × 5,787 × 10^{-3}) V				
≥ 11.8460 V	overflow		2047 × 16	7FF0
≥ 11.7592 V		at ↑ DIA Measured value out of range ON	2032 × 16	7F00
11.7535 V	over-drive		2031 × 16	7EF0
≤ 11.6030 V		at ↓ DIA Measured value out of range OFF	2005 × 16	7D50
10.0058 V			1729 × 16	6C10
10.000000 V	nominal range		1728 × 16	6C00
…			…	…
5.0000 V			864 × 16	3600
…			…	…
0.000578 V			1 × 16	0010
0.000000 V			0	0000
-0.000578 V			-1 × 16	FFF0
…			…	…
-5.000000 V			-864 × 16	CA00
…			…	…
-10.000000V			-1728 × 16	9400
-10.0058 V	under-drive		-1729 × 16	93F0
≥ -11,6030 V		at ↑ DIA Measured value out of range OFF	-2005 × 16	82B0
-11.7592 V			-2032 × 16	8100
-11.7650 V	underflow	at ↓ DIA Measured value out of range ON	-2033 × 16	80F0
≤ -11.8518 V			-2048 × 16	8000

0 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value/16 × 5,787 × 10^{-3}) V				
≥ 11.8460 V	overflow		2047 × 16	7FF0
≥ 11.7592 V		at ↑ DIA Measured value out of range ON	2032 × 16	7F00
11.7535 V	over-drive		2031 × 16	7EF0
≤ 11.6030 V		at ↓ DIA Measured value out of range OFF	2005 × 16	7D50
10.0058 V			1729 × 16	6C10
10.000000 V	nominal range		1728 × 16	6C00
…			…	…
5.0000 V			864 × 16	3600
…			…	…
0.000578 V			1 × 16	0010
0.00000 V			0	0000
≥ -0.050 V	underflow	at ↑ DIA Overflow/underflow OFF	0	0000
< -0,100 V		at ↓ DIA Overflow/underflow ON	0	0000

0 ... 20 mA	bipolar	Diagnostics	dec.	hex.
current $value_M$ = (dec. value/16 × 0,01157) mA				
≥ 23.6921 mA	overflow		2047 × 16	7FF0
≥ 23.51852 mA		at ↑ DIA Measured value out of range ON	2032 × 16	7F00
23.5069 mA	over-drive		2031 × 16	7EF0
≤ 23.2060 mA		at ↓ DIA Measured value out of range OFF	2005 × 16	7D50
20.0116 mA			1729 × 16	6C10
20.000000 mA	nominal range		1728 × 16	6C00
…			…	…
10.0000 mA			864 × 16	3600
…			…	…
0.01157 mA			1 × 16	0010
≤ 0.0000 mA			0	0000
≥ -0,1 mA	underflow	at ↑ DIA Overflow/underflow OFF	0	0000
< -0,2 mA		at ↓ DIA Overflow/underflow ON	0	… 0000

4 ... 20 mA	bipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value/16 × 9,259 × 10^{-3}) + 4) mA				
≥ 22.9537 mA	overflow		2047 × 16	7FF0
≥ 22.8148 mA		at ↑ DIA Measured value out of range ON	2032 × 16	7F00
22.8056 mA	over-drive		2031 × 16	7EF0
≤ 22.5648 mA		at ↓ DIA Measured value out of range OFF	2005 × 16	7D50
20.0093 mA			1729 × 16	6C10
20.000000 mA	nominal range		1728 × 16	6C00
...			...	...
12.0000 mA			864 × 16	3600
...			...	...
4.00925 mA			1 × 16	0010
40000 mA			0	0000
3.9907 mA	under-drive		-1 × 16	FFF0
≥ 1.2963 mA		at ↑ DIA Measured value out of range OFF	-292 × 16	EDC0
1.1851 mA			-304 × 16	ED00
≤ 1.1759 mA	underflow	at ↓ DIA Measured value out of range ON	-305 × 16	ECF0
≤ 0.000 mA			-432 × 16	E500

Value representation process automation (NE 43)

- 16-bit-representation

The hexadecimal value transmitted by the module has to be interpreted as decimal value, which corresponds, if multiplied with a defined factor, to the analog value.

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 0,001) V				
≥ 11,000 V	overflow	at ↑ DIA Overflow/underflow ON	11000	2AF8
≤ 10.999 V		at ↓ DIA Overflow/underflow OFF	10999	2AF7
10.501 V		at ↑ DIA Measured value out of range ON	10501	2905
≥ 10.500 V	over-drive		10500	2904
≤ 10.250 V		at ↓ DIA Measured value out of range OFF	10250	280A
10.001 V			10001	2711
10.000 V	nominal range		10000	2710
…			…	…
5.000 V			5000	1388
…			…	…
0.001 V			1	0001
0.0000 V			0	0000
-0.001 V			-1	FFFF
…			…	…
-5.0000 V			-5000	EC78
…			…	…
-10.000 V			-10000	D8F0
- 10,001 V	under-drive		-10001	D8EF
-10.250 V		at ↑ DIA Measured value out of range OFF	-10250	D7F6
-10.500 V		at ↓ DIA Measured value out of range ON	-10500	D6FC
-10.501 V	underflow		-10501	D6FB
-10.999 V		at ↑ DIA Overflow/underflow OFF	-10999	D509
≤ -11.000 V		at ↓ DIA Overflow/underflow ON	-11000	D508

0 ... 10 V	unipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 0,001) V				
≥ 11,000 V	overflow	at ↑ DIA Overflow/underflow ON	11000	2AF8
≤ 10,999 V		at ↓ DIA Overflow/underflow OFF	10999	2AF7
10.501 V		at ↑ DIA Measured value out of range ON	10501	2905
≥ 10.500 V	over-drive		10500	2904
≤ 10.250 V		at ↓ DIA Measured value out of range OFF	10250	280A
10.001 V			10001	2711
10.000 V	nominal range		10000	2710
...			...	...
5.000 V			5000	1388
...			...	...
0.001 V			1	0001
0.000 V			0	0000
≥ - 0,05 V	underflow	at ↑ DIA Overflow/underflow OFF	0	0000
< -0,10 V		at ↓ DIA Overflow/underflow ON	0	0000

0 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 0,001) mA				
≥ 22,000 mA	overflow	at ↑ DIA Overflow/underflow ON	22000	55F0
≤ 21.999 mA		at ↓ DIA Overflow/underflow OFF	21999	55EF
21.001 mA		at ↑ DIA Measured value out of range ON	21001	5209
≥ 21.000 mA	over-drive		21000	5208
≤ 20.500 mA		at ↓ DIA Measured value out of range OFF	20500	5014
20.001 mA			20001	4E21
20,000 mA	nominal range		20000	4E20
...			...	...
10.000 mA			10000	2712
...			...	...
0.001 mA			1	0001
0.0000 mA			0	0000
≥ -0.1 mA	underflow	at ↑ DIA Overflow/underflow OFF	0	0000
< -0,2 mA		at ↓ DIA Overflow/underflow ON	0	0000

4 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value × 0,001) mA				
≥ 22,000 mA	overflow	at ↑ DIA Overflow/under-flowON	22000	55F0
≤ 21.999 mA		at ↓ DIA Overflow/underflow OFF	21999	55EF
21.001 mA		at ↑ DIA Measured value out of range ON	21001	5209
≥ 21.000 mA	over-drive		21000	5208
≤ 20.500 mA		at ↓ DIA Measured value out of range OFF	20500	5014
20.001 mA			20001	4E21
20,000 mA	nominal range		20000	4E20
...			...	...
12.000 mA			12000	2EE0
...			...	...
4.001 mA			4001	0FA1
4.000 mA			4000	0FA0
3.999 mA	under-drive		3999	0F9F
≥ 3.800 mA		at ↑ DIA Measured value out of range OFF	3800	0ED8
3.600 mA		at ↓ DIA Measured value out of range ON	3600	0E10
3.599 mA	underflow		3599	0E0F
≥ 2,001 mA		at ↑ DIA Wire break OFF	2001	07D1
≤ 2.000 mA		at ↓ DIA Wire break ON	2000	07D0
0.000 mA			0000	0000

- 12-bit-representation (left-justified)

The 12-bit-representation (left-justified) in process automation corresponds to the 15-bit-representation in which the lower 4 bits of the analog value are overwritten with diagnostic data.

-10 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 0.001) V				
≥ 11,008 V	overflow	at ↑ DIA Overflow/underflow ON	11008	2B0×
≤ 10.992 V		at ↓ DIA Overflow/underflow OFF	10992	2AF×
10.512 V		at ↑ DIA Measured value out of range ON	10512	291×
≥ 10.496 V	over-drive		10496	290×
≤ 10.256 V		at ↓ DIA Measured value out of range OFF	10256	281×
10.016 V			10016	272×
10.000 V	nominal range		10000	271×
…				
4.992 V			4992	138×
…			…	…
0.016 V			16	001×
0.0000 V			0	000×
-0.016 V			-16	FFF×
…			…	…
-4.992 V			-4992	EC8×
…			…	…
-10.000 V			-10000	D8F×
- 10,016 V	under-drive		-10016	D8E×
-10.256 V		at ↑ DIA Measured value out of range OFF	-10256	D7F×
-10.496 V			-10496	D70×
-10.512 V	underflow	at ↓ DIA Measured value out of range ON	-10512	D6F×
-10.992 V		at ↑ DIA Overflow/underflow OFF	-10992	D51×
≤ -11.008 V		at ↓ DIA Overflow/underflow ON	-11008	D50×

0 ... 10 V	bipolar	Diagnostics	dec.	hex.
voltage value U_M = (dec. value × 0,001) V				
≥ 11,008 V	overflow	at ↑ DIA Overflow/underflow ON	11008	2B0×
≤ 10.992 V		at ↓ DIA Overflow/underflow OFF	10992	2AF×
10.512 V		at ↑ DIA Measured value out of range ON	10512	291×
≥ 10.496 V	over-drive		10496	290×
≤ 10.256 V		at ↓ DIA Measured value out of range OFF	10256	281×
10.016 V			10016	272×
10.000 V	nominal range		10000	271×
...				
4.992 V			4992	138×
...			...	...
0.016 V			16	001×
≤ 0.0000 V			0	000×
≥ -0.05 V	underflow	at ↑ DIA Overflow/underflow OFF	0	000×
< -0,1 V		at ↓ DIA Overflow/underflow ON	0	000×

0 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value/16 × 0,001) mA				
≥ 22,000 mA	overflow	at ↑ DIA Overflow/underflow ON	22000	55F×
≤ 21.984 mA		at ↓ DIA Overflow/underflow OFF	21984	55E×
21.024 mA			21024	522×
≥ 21.008 mA	over-drive	at ↑ DIA Measured value out of range ON	21008	521×
≤ 20.496 mA		at ↓ DIA Measured value out of range OFF	20496	501×
20.016 mA			20016	4E3×
20,000 mA	nominal range		20000	4E2×
...			...	...
10.000 mA			10000	271×
...			...	...
0.016 mA			16	001×
0.0000 mA			0	000×
≥ -0.1 mA	underflow	at ↑ DIA Overflow/underflow OFF	0	000×
< -0,2 mA		at ↓ DIA Overflow/underflow ON	0	000×

4 ... 20 mA	unipolar	Diagnostics	dec.	hex.
current value$_M$ = (dec. value/16 × 0,001) mA				
≥ 22,000 mA	overflow	at ↑ DIA Overflow/underflow ON	22000	55F×
≤ 21.984 mA		at ↓ DIA Overflow/underflow OFF	21984	55E×
≥ 21.008 mA	over-drive	at ↑ DIA Measured value out of range ON	21008	521×
≤ 20.992 mA			20496	5010
≤ 20.496 mA		at ↓ DIA Measured value out of range OFF		
20.016 mA			20016	4E3×
20,000 mA	nominal range		20000	4E2×
...			...	...
12.000 mA			12000	2EE×
...			...	...
4.016 mA			4016	0FB×
4.000 mA			4000	0FA×
3.984 mA	under-drive		3984	0F9×
≥ 3.792 mA		at ↑ DIA Measured value out of range OFF	3792	0ED×
< 3,600 mA		at ↓ DIA Measured value out of range ON	3600	0E1×
3.584 mA	underflow		3584	0E0×
≥ 2,001 mA		at ↑ DIA Wire break OFF	2001	07D×
< 2.000 mA		at ↓ DIA Wire break ON	2000	07D×
0.000 mA			0000	000×

10.1.6 Measurement value representation of the outputs

Standard representation

- 16-bit-representation

	dec.	hex.	bipolar	-10 ... 10 V
dec. value = 3276,7 [1/V] × voltage value [V]				
100.00 %	32767	7FFF	nominal range	10.0000 V
99.99695 %	32766	7FFE		9.9997 V
	…	…		…
50.00153 %	16384	4000		5.0002 V
	…	…		…
0.00305 %	1	0001		0.000305 V
0.00000 %	0	0000		0.000000 V
-0.00305 %	-1	FFFF		-0.000305 V
	…	…		…
-50.00000 %	-16384	C000		-5.0000 V
	…	…		…
-99.99695 %	-32767	8001		-9.9997 V
-100.00 %	-32768	8000		- 10.0000 V

	dec.	hex.	unipolar	0 ... 10 V
dec. value = 3276,7 [1/V] × voltage value [V]				
100.00 %	32767	7FFF	nominal range	10.0000 V
99.99695 %	32766	7FFE		9.9997 V
	…	…		…
50.00153 %	16384	4000		5.0002 V
	…	…		…
0.00305 %	1	0001		0.000305 V
0.00000 %	0	0000		0.000000 V
-0.00305 %	-1	FFFF	DIA Output value out of range ON at FFFF to 8000	0.000000 V
	…	…		…
-50.00000 %	-16384	C000		0.000000 V
	…	…		…
-99.99695 %	-32767	8001		0.000000 V
-100.00 %	-32768	8000		0.000000 V

- 12-bit-representation (left-justified)

	dec.	**hex.**	**bipolar**	**-10 ... 10 V**
dec. value = 204,7 [1/V] × voltage value [V] × 16				
100.000 %	2047 × 16	7FFF	nominal range	10.0000 V
99.951 %	2046 × 16	7FEx		9.9951 V
	…	…		…
0.04885 %	1 × 16	001×		0.004885 V
0.00000 %	0	000×		0.000000 V
-0.04883 %	-1 × 16	FFF×		-0.004883 V
	…	…		…
-99.95 %	-2047 × 16	801×		-9.9951 V
-100.00 %	-2048 × 16	800×		- 10.0000 V

	dec.	**hex.**	**unipolar**	**0 ... 10 V**
dec. value = 409,5 [1/V] × voltage value [V] × 16				
100.00 %	4095 × 16	FFF×	nominal range	10.0000 V
99.976 %	4094 × 16	FFEx		9.9976 V
	…	…		…
50.012%	2048 × 16	800×		5.0021 V
	…	…		…
0.0244 %	1 × 16	001×		0.002442 V
0.00000 %	0	000×		0.000000 V

Extended range - value representation

- 16-bit-representation

	dec.	hex.	bipolar	-10 ... 10 V
dec. value = 2764,8 [1/V] × voltage value [V]				
118.515 %	32767	7FFF	DIA Output value out of range ON at 7F00 to 7FFF	11.851 V
118.461 %	32752	7FF0		11.846 V
117.593 %	32512	7F00		11.7593 V
117.589 %	32511	7EFF	overdrive	11.7589 V
117.535 %	32496	7EF0		11.7535 V
100.058 %	27664	6C10		10.0058 V
≥ 100,004 %	27649	6C01		10.0004 V
100.000 %	27648	6C00	nominal range	10 V
0.05787 %	16	0010		5.787 mV
0.003617 %	1	0001		361,7 µV
0.000 %	0	0000		0 V
-0.00362 %	-1	FFFF		-361,7 µV
-0.05787 %	-16	FFF0		- 5.787 mV
-25.000 %	-6912	E500		-2.5 V
-100.000 %	-27648	9400		-10 V
≤ -100.004 %	-27649	93FF	underdrive	-10.0004 V
-100.058 %	-27664	93F0		-10.0058 V
-117.593 %	-32512	8100		-11.7593 V
-117.596 %	-32513	80FF	DIA Output value out of range ON at 08FF to 8000	11.7596 V
-118.461 %	-32752	80F0		-11.846 V
-118.519 %	-32768	8000		-11.852 V

	dec.	hex.	unipolar	0 ... 10 V
dec. value = 2764,8 [1/V] × voltage value [V]				
118.515 %	32767	7FFF	DIA Output value out of range ON at 7F00 to 7FFF	11.851 V
118.461 %	32752	7FF0		11.846 V
117.593 %	32512	7F00		11.7593 V
117.589 %	32511	7EFF	overdrive	11.7589 V
117.535 %	32496	7EF0		11.7535 V
100.058%	27664	6C10		10.0058 V
≥ 100,004 %	27649	6C01		10.0004 V
100.000 %	27648	6C00	nominal range	10 V
0.05787 %	16	0010		5.787 mV
0.003617 %	1	0001		361,7 µV
0.000 %	0	0000		0.00 V
-0.00362 %	-1	FFFF	DIA Overflow/underflow ON at FFFF to 8000	0.00 V
-0.05787 %	-16	FFF0		0.00 V
-25.000 %	-6912	E500		0.00 V
-100.000 %	-27648	9400		0.00 V
≤ -100.004 %	-27649	93FF		0.00 V
-100.058 %	-27664	93F0		0.00 V
-117.593 %	-32512	8100		0.00 V
-117.596 %	-32513	80FF		0.00 V
-118.461 %	-32752	80F0		0.00 V
-118.519 %	-32768	8000		0.00 V

- 12-bit-representation (left-justified)

The representation of the 12 bit values corresponds to that of the 16 bit values. Only bits 0 to 3 are set to "0".

Value representation process automation (NE 43)

- 16-bit-representation

	dec.	hex.	bipolar	-10 ... 10 V
dec. value = 1000 [1/V] × voltage value [V]				
327.67 %	32767	7FFF	DIA Overflow/underflow ON at 2AF9 to 7FFF	11.000 V
110, 01 %	11001	2AF9		11.000 V
110.00 %	11000	2AF8	DIA Output value out of range ON at 2905 to 7FFF	11.000 V
105.01 %	10501	2905		10.501 V
105.00 %	10500	2904	overdrive	10.500 V
100.01 %	10001	2711		10.001 V
100.000 %	10000	2710	nominal range	10.000 V
40.00 %	4000	0FA0		4.000 V
0.01 %	1	0001		0.001 V
0.000 %	0	0000		0 V
-0.01 %	-1	FFFF		-0.001 V
-40.00 %	-4000	F060		-4.000 V
-100.00 %	-10000	D8F0		-10.000 V
≤ -100,01 %	-10001	D8EF	underdrive	-10.001 V
-105.00 %	-10500	D6FC		-10.500 V
-105.01 %	-10501	D6FB	DIA Output value out of range ON at D6FB to 8000	-10.501 V
-110.00 %	-11000	D508		-11.000 V
-110.01 %	-11001	D507	DIA Overflow/underflow ON at D507 to 8000	-11.000 V
-327.68 %	-32768	8000		-11.000 V

	dec.	hex.	unipolar	0 ... 10 V
dec. value = 1000 [1/V] × voltage value [V]				
655.35 %	65535	FFFF	DIA Overflow/underflow ON at 2AF9 to FFFF	11.000 V
110, 01 %	11001	2AF9		11.000 V
110.00 %	11000	2AF8	DIA Output value out of range ON at 2905 to FFFF	11.000 V
105.01 %	10501	2905		10.501 V
105.00 %	10500	2904	overdrive	10.500 V
100.01 %	10001	2711		10.001 V
100.000 %	10000	2710	nominal range	10.000 V
40.00 %	4000	0FA0		4.000 V
20.00 %	2000	07D0		2.000 V
0.01 %	1	0001		0.001 V
0.000 %	0	0000		0 V

- 12-bit-representation (left-justified)

The representation of the 12 bit values corresponds to that of the 16 bit values. Only bits 0 to 3 are set to "0".

10.1.7 Base modules/pin assignment

- BL67-B-4M12

Figure 10-3: BL67-B-4M12

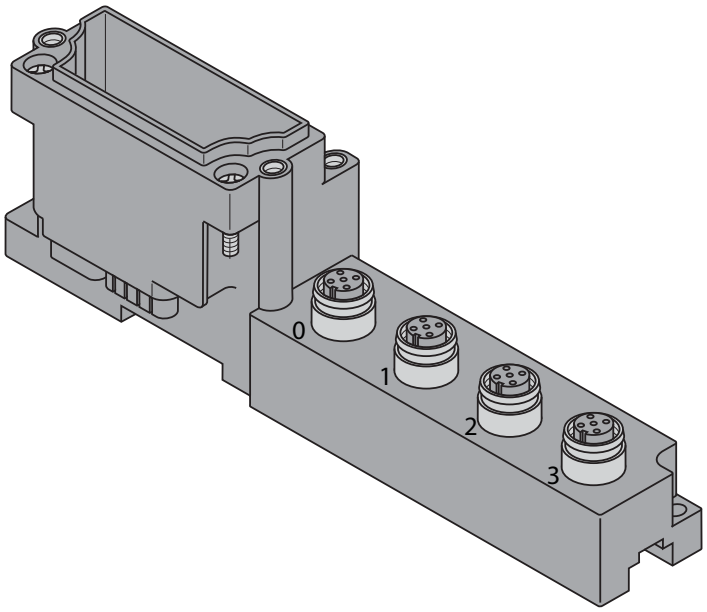
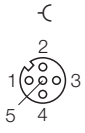


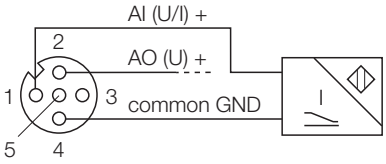
Table 10-1: Pin assignment BL67-4AI4AO-V/I with BL67-B-4M12



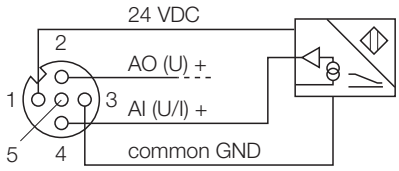
1 = V_{SENS}
2 = AO +
3 = GND
4 = AI +
5 = PE

Figure 10-4: Connection options for BL67-4AI4AO-VI with M12

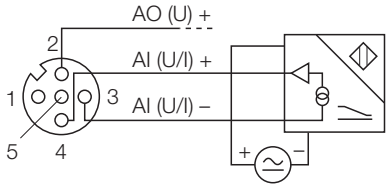
2-wire connection technology of the analog input



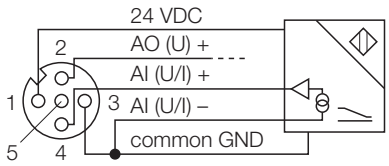
3-wire connection technology of the analog input



3-wire connection technology of the analog input with separate voltage supply



3-wire connection technology of the analog input (4-wire sensor with external bridge)



- BL67-2M12-8/BL67-2M12-8-P

Figure 10-5: BL67-B-2M12/ BL67-B-2M12-8-P

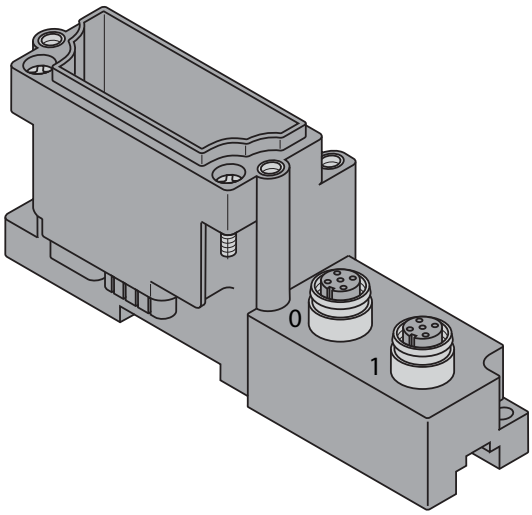
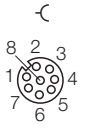


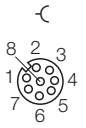
Table 10-2: Pin assignment BL67-4AI4AO-V/I with BL67-B-2M12-8

slot 0



1 = AI 0 +	5 = V_{SENS}
2 = AI 2 +	6 = V_{SENS}
3 = AO 0 +	7 = GND
4 = AO 2 +	8 = PE

slot 1



1 = AI 1 +	5 = V_{SENS}
2 = AI 3 +	6 = V_{SENS}
3 = AO 1 +	7 = GND
4 = AO 3 +	8 = PE

Table 10-3: Pin assignment BL67-4AI4AO-V/I with BL67-B-2M12-8-P

slot 0

1 = AI 0 +	5 = V_{SENS}
2 = AI 1 +	6 = V_{SENS}
3 = AO 0 +	7 = GND
4 = AO 1 +	8 = PE

slot 1

1 = AI 2 +	5 = V_{SENS}
2 = AI 3 +	6 = V_{SENS}
3 = AO 2 +	7 = GND
4 = AO 3 +	8 = PE

- BL67-B-8M8

Figure 10-6: BL67-B-8M8

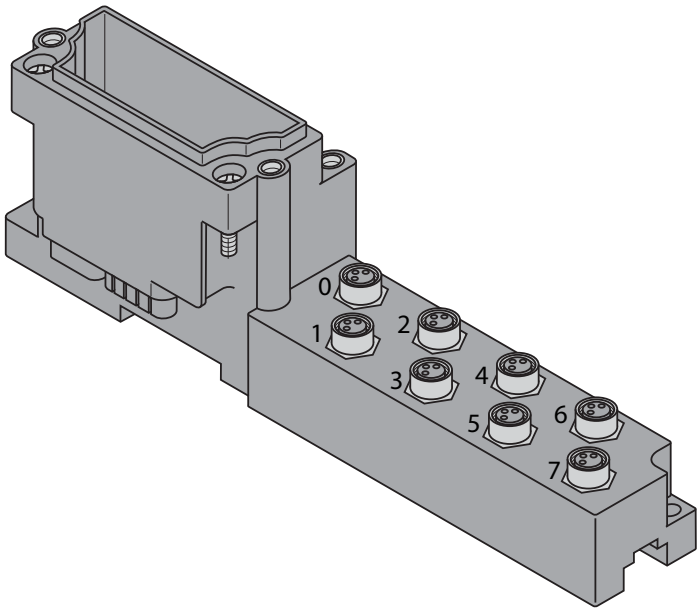
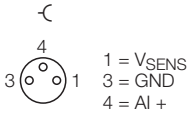
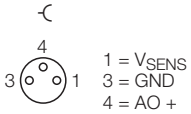


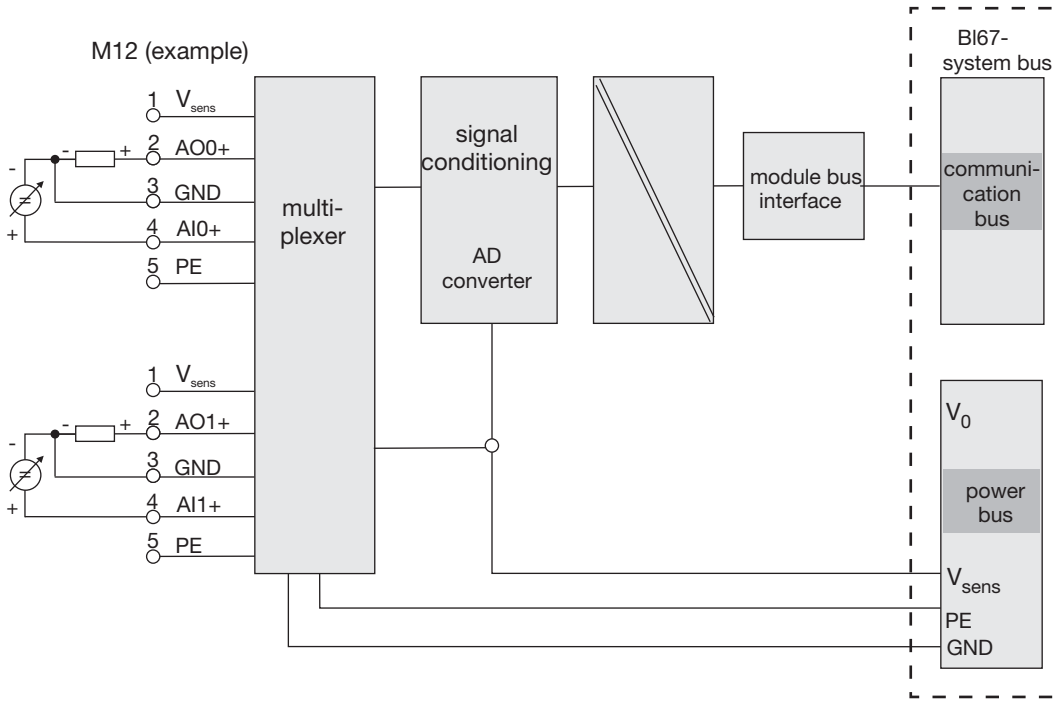
Table 10-4: Pin assignment BL67-4AI4AO-V/I with BL67-B-8M8

slot 0 - 3	slot 4 - 7
	
1 = V_{SENS} 3 = GND 4 = AI +	1 = V_{SENS} 3 = GND 4 = AO +

10.2 BL67-2AI2AO-VI, voltage/current

Figure 10-7:
BL67-2AI2AO-V/I

Figure 10-8:
Block diagram



10.2.1 Technical data

Table 10-5: Technical data

Designation	BL67-2AI2AO-V/I
No. of channels	2/2
Nominal voltage from supply terminal	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption at 5 VDC (module bus) I_{MB}	≤ 50 mA
Nominal current from supply terminal (field) I_L	≤ 50 mA
Power loss of the module, typical P_{MAX}	< 1 W
Input signal in current measurement	
Input resistance (burden)	< 125 Ω (typ. 65 Ω)
Input current (range which can be evaluated by the A/D converter)	0 to 20 mA 4 to 20 mA
Input current (maximum - an "Measured value out of range" is shown if the current is above 20.2 mA)	50 mA
Cutoff frequency (-3 dB)	20 Hz
Input signal in voltage measurement	
Input resistance (burden)	> 98,5 kΩ (typ. 225 kΩ)
Input voltage (range which can be evaluated by the A/D converter)	-10 to 10 VDC 0 to 10 VDC
Input voltage (maximum - a deviation of 1 % already generates a "Measured value out of range" message)	35 VDC
Cutoff frequency (-3 dB)	20 Hz
accuracy of the input signal	
Basic error at 23 °C/73.4 °F	< 0.3 %
Temperature coefficient	≤ 300 ppm/°C from end value
Output signal in voltage measurement	
Output voltage U_A	-10/0 to 10 VDC
Burden resistance	
– Resistive load R_{LO}	> 1 kΩ
– Capacitive load R_{Lk}	< 1 µF
Short-circuit current I_K	≤ 40 mA
Transmission frequency f_T	< 100 Hz

Basic error at 23 °C/73.4 °F	0.3 %
Repeat accuracy	0,05 %
Output ripple	0.02 %
Temperature coefficient	≤ 300 ppm/°C from end value
Settling time (maximum)	
– Resistive load	max. 0,5 ms
– Inductive load	max. 2,0 ms
– Capacitive load	max. 2,0 ms
Common mode error	min. 90 dB
Differential mode error	min. 70 dB
Crosstalk suppression	min. - 50 dB
Isolation voltages	
U_{TMB} (module bus/field)	min. 500 VDC
U_{PE} (field/PE)	min. 500 VDC
Resolution of the A/D converter	16 bit

10.2.2 Process data mapping

Data	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Input	n	AI0 LSB							
	n + 1	AI0 MSB							
	n + 2	AI1 LSB							
	n + 3	AI1 MSB							
Output	m	AO0 LSB							
	m + 1	AO0 MSB							
	m + 2	AO1 LSB							
	m + 3	AO1 LSB							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

NOTE

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master. For DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

Table 10-6: Process data bits

Process data	Meaning
AI1 LSB	low byte of the analog value
AIx MSB	high byte of the analog value
AOx LSB	low byte of the analog value
AOx LSB	high byte of the analog value

10.2.3 Diagnostic and status messages

LED status displays

Table 10-7: LED status displays

LED	Display	Meaning	Remedy
D	red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	–
0/1	Green	Input channel x active	-
	Green flashing, 0.5 Hz	Underflow diagnostic at input	-
	Green flashing, 4 Hz	Overflow diagnostic at input	-
	OFF	Input channel x inactive	

Diagnostic data

This module has the following diagnostic data available **per channel**:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Hardware failure	-	-	-	Overflow/ underflow	-	Wire break	Measured value/ output value out of range

NOTE

In the 12-bit-representation (left-justified) the diagnostic data are transmitted with the lower nibble of the process data for the respective channel.

Table 10-8: Diagnostics

Diagnostics	Meaning
Measured value out of range	Indicates an over- or undercurrent of 1 % of the set current range; whereby, undercurrents can only be recognized with those modules that have a set current range of 4 to 20 mA.
Output value out of range	Underrun/overrun of the valid output range (limit values see page 10-27ff.)
Wire break (only 4-20 mA)	Displays a wire break in the signal line for the operating mode 4 to 20 mA. (I < 3 m)
Overflow/underflow, OUFL (NE 43 only)	The output value lies under or over the set output value and can not be given out (limit values see page 10-27)
Hardware failure	Shows common errors of the module hardware (e.g. CRC-error, calibration error, …). The return analog value in case of an error is "0". Module exchange necessary!

10.2.4 Module parameters

NOTE

Due to a product actualization, the parameter texts of the TURCK-I/O-product have been revised.
The actual configuration files (GSD-, GSDML-, EDS-files) with the new parameters can be found under www.turck.com.
If you use older configuration files with old parameter texts (issue date before April 2014), then you can find a cross reference list in the manual's appendix (see Cross reference list parameters (page 15-30)).

	Standard				PROFIBUS/ PROFINET		Parameter
	byte-oriented		word-oriented				
Input 0	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Operation mode
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	Data format
		Bit 5		Bit 5		Bit 5	Deactivate diagnostics
		Bit 6		Bit 6		Bit 6	reserved
		Bit 7		Bit 7		Bit 7	
Output 0	Byte 1	Bit 0		Bit 8	Byte 2	Bit 0	Operation mode
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	Data format
		Bit 5		Bit 13		Bit 5	Deactivate diagnostics
		Bit 6		Bit 14		Bit 6	Output on module bus error
		Bit 7		Bit 15		Bit 7	
	Byte 2	Bit 0	Word 1	Bit 0	Byte 1	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

	Standard				PROFIBUS/ PROFINET		Parameter
	byte-oriented		word-oriented				
Input 1	Byte 4	Bit 0	Word 2	Bit 0	Byte 5	Bit 0	Operation mode
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	Data format
		Bit 5		Bit 5		Bit 5	Deactivate diagnostics
		Bit 6		Bit 6		Bit 6	reserved
		Bit 7		Bit 7		Bit 7	
Output 1	Byte 5	Bit 0		Bit 8	Byte 4	Bit 0	Operation mode
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	Data format
		Bit 5		Bit 13		Bit 5	Deactivate diagnostics
		Bit 6		Bit 14		Bit 6	Output on module bus error
		Bit 7		Bit 15		Bit 7	
	Byte 6	Bit 0	Word 3	Bit 0	Byte 6	Bit 0	Substitute value (low byte)
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 7	Bit 0		Bit 8	Byte 8	Bit 0	Substitute value (high byte)
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

NOTE

Concerning the "number representation", please observe the tables for measurement value representation on the following pages.

Table 11: Module parameters

A *default settings*
B *for in- and outputs*
C *only for inputs*

Parameter	settings
Operation mode	0000 = voltage, -10 … 10 VDC standard **A, B** 0001 = voltage, 0 … 10 VDC standard **B** 0010 = voltage, -10 … 10 VDC PA (NE 43) **B** 0011 = voltage, 0 … 10 VDC PA (NE 43) **B** 0100 = voltage, -10 … 10 VDC ext. range **B** 0101 = voltage, 0 … 10 VDC ext. range **B** 0110 = reserved 0111 = reserved 1000 = 0 … 20 mA standard **A, C** 1001 = 4 … 20 mA standard**, C** 1010 = 0 … 20 mA PA (NE 43) C 1011 = 4 … 20 mA PA (NE 43) C 1100 = 0 … 20 mA ext. range **C** 1101 = 4 … 20 mA ext. range **C** 1111 = deactivate
Data format	0 = 15 bit + sign **A** 1 = 12 bit (left-justified)
Deactivate diagnostics	0 = no **A** 1 = yes
Output on module bus error	0 = substitute value **A** 1 = current value
Substitute value Ax	Substitute value = "0" **A** 1. The substitute value defined here will be sent in consequence of certain events parameterized in the gateway. or 2. In case of a module bus error: The substitute value defined here will be sent if the parameter "Behavior module bus error Ax" is set to "output substitute value".

10.2.5 Measurement value representation

the measurement value representation corresponds to that of the module BL67-4AI4AO-VI.

Measurement value representation of the inputs, page 10-11

Measurement value representation of the outputs, page 10-27

10.2.6 Base modules/pin assignment

- BL67-B-2M12-8/BL67-B-2M12-8-P

Figure 10-9: BL67-B-2M12/ BL67-B-2M12-8-P

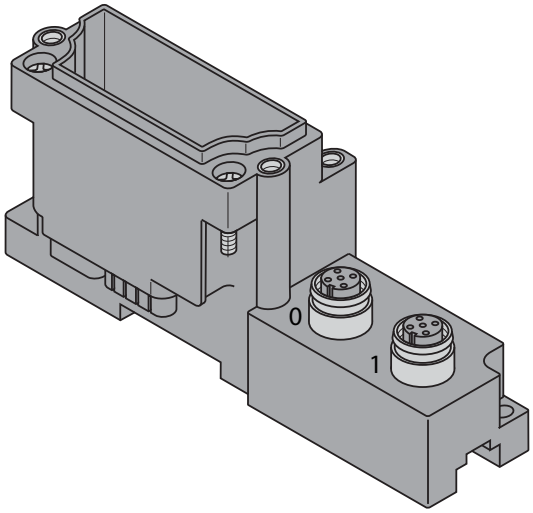


Table 10-1: Pin assignment BL67-2AI2AO-V/I with BL67-B-2M12-8

slot 0:

1 = AI 0 – 5 = V_{SENS}
2 = AO 0 – 6 = V_{SENS}
3 = AI 0 + 7 = GND
4 = AO 0 + 8 = PE

slot 1:

1 = AI 1 – 5 = V_{SENS}
2 = AO 1 – 6 = V_{SENS}
3 = AI 1 + 7 = GND
4 = AO 1 + 8 = PE

Table 10-2: Pin assignment BL67-2AI2AO-V/I with BL67-B-2M12-8-P

slot 0:

1 = AI 0 – 5 = V_{SENS}
2 = AI 1 – 6 = V_{SENS}
3 = AI 0 + 7 = GND
4 = AI 1 + 8 = PE

slot 1:

1 = AO 0 – 5 = V_{SENS}
2 = AO 1 – 6 = V_{SENS}
3 = AO 0 + 7 = GND
4 = AO 1 + 8 = PE

11 Relay modules

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11.1 General

BL67 relay modules (R) receive output values from the gateway via the internal module bus. The modules convert these values and transmit the corresponding circuit state for each channel to the field level via the base modules.

Relay modules are suitable for solenoid valves, DC contactors and signal lamps in the nominal-load voltage range 24 V DC/V AC to 230 V AC. Relay modules have a reverse polarity protection and are potentially isolated from the power supply.

ATTENTION!

Electric arc when switching inductive loads

Destruction of contacts

➤ Provide an external suppressor.

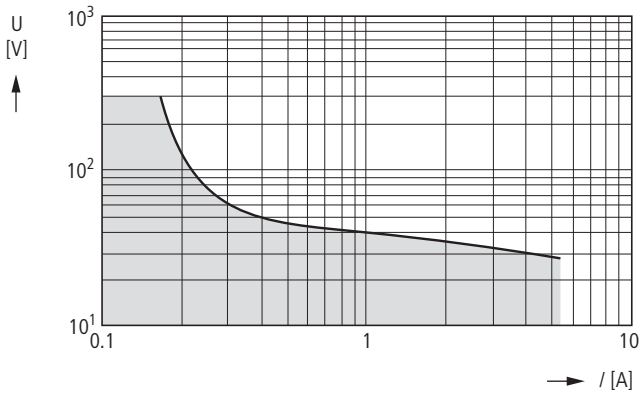
LED status indicators

Error signals from the I/O level are indicated by each module via the "D" LED. The corresponding diagnostic information is transmitted to the gateway via diagnostic bits. If the "D" LED lights up continuously red, it signals the failure of the module bus communication of the relay modules.

11.1.1 Load limit curve with resistive load

At 1 000 switching cycles, no sustained arcs with a burning life > 10 ms may occur.

Figure 11-1: Definition of load limit curve



ATTENTION!

Switching of too high loads/power

Destruction of contacts

➤ Observe the devices' load limit curve.

11.1.2 Module overview

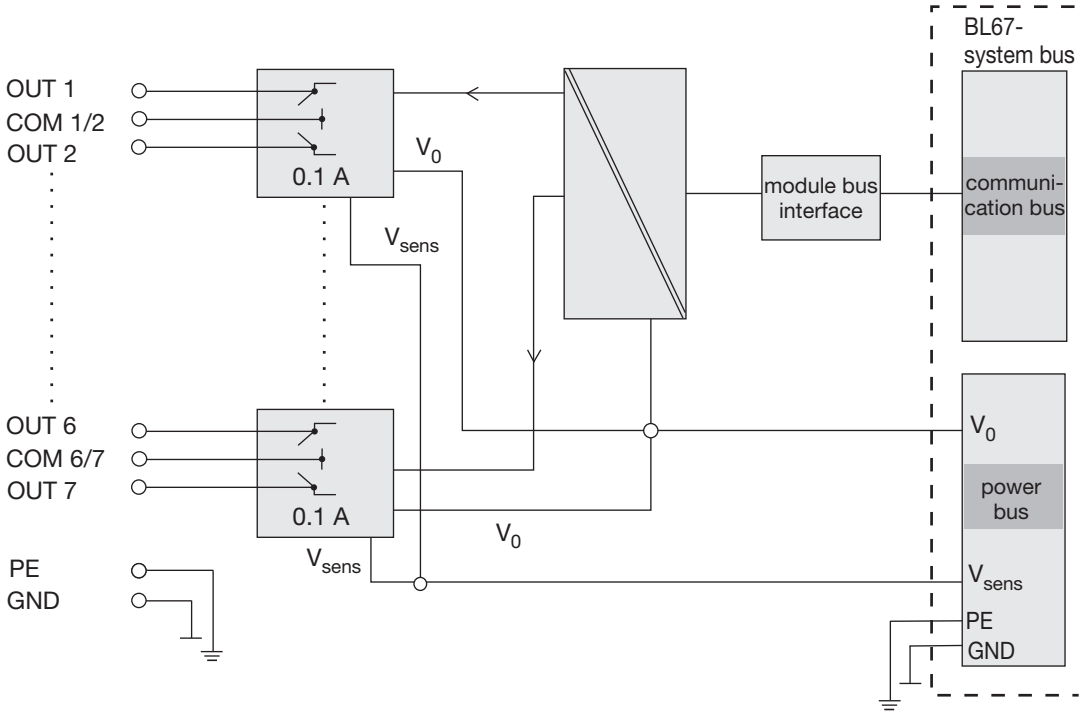
Table 11-1: Overview Relay modules

BL67-8DO-R-NO	normally open contact

11.2 BL67-8DO-R-NO

Figure 11-2:
BL67-8DO-R-NO

Figure 11-3:
Block diagram



11.2.1 Technical data

Table 11-2: Technical data

Designation	BL67-8DO-R-NO
No. of channels	8 normally open contacts
Nominal voltage from supply terminal	24 VDC
Load voltage V_O	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 50 mA
Nominal current from supply terminal I_L	-
Power loss of the module, typical	typ. < 2 W
Switching resistor	< 31 Ω
Switch-on resistance R_{on}	max. 25 Ω
Output current I_A per channel	
at 25 °C	100 mA
at 55 °C	50 mA
Load type	ohmic, TTL logic
Switching frequency, resistive	< 200 Hz
Simultaneity factor	100 %
Isolation voltages	
Module bus/field	1500 VDC
Relay/relay (contact group/contact group)	300 VDC
Contact/contact (open contact)	50 VDC

11.2.2 Diagnostic and status messages

LED status displays

Table 11-3: LED status displays

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	OFF	No error messages or diagnostics	-
0 to 7	Green	Status of channel x = "1"	-
	OFF	Status of channel x = "0"	-

Diagnostic data

none

11.2.3 Module parameters

none

11.2.4 Base modules/pin assignment

- BL67-B-4M12-P

Figure 11-4: BL67-B-4M12

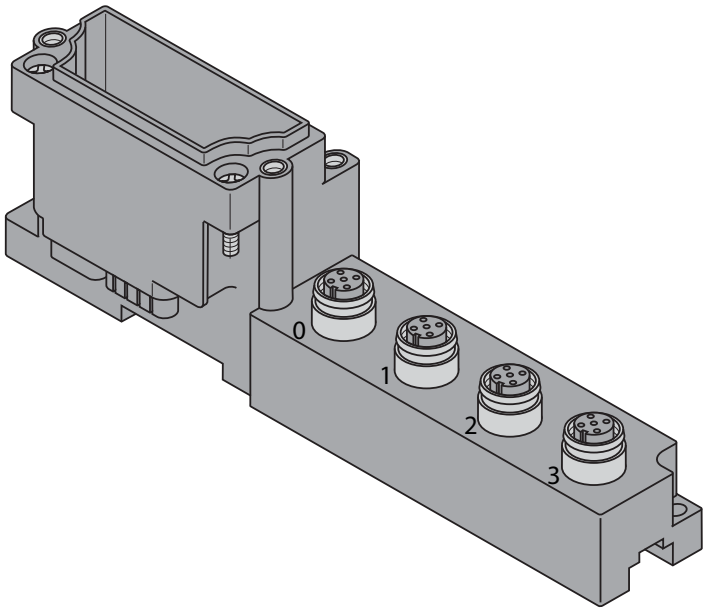


Figure 11-5: Pin assignment

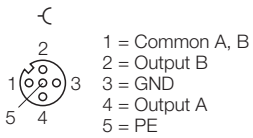
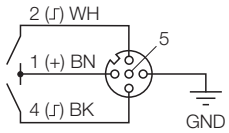
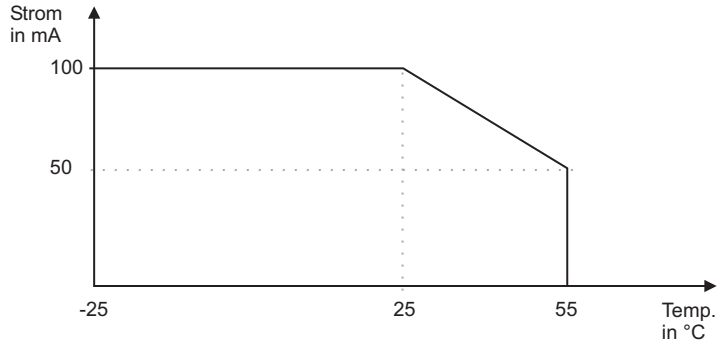


Figure 11-6: Wiring diagram



11.2.5 Derating

Figure 11-7: Derating of the PhotoMOS-relays



11.2.6 Signal assignment

Table 11-4: Signal assignment with BL67-B-4M12-P

	Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Out	m	C3P2	C3P4	C2P2	C2P4	C1P2	C1P4	C0P2	C0P4

m = Offset of process output data; depending on extension of station and the corresponding fieldbus.

C = slot no.

P = pin no.

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12.1 BL67-1RS232

The module BL67-1RS232 transmits serial data through the BL67 system via a RS232 interface and enables the connection of different devices (printer/scanner/bar code reader), which as well provide a serial RS232 interface.

12.1.1 Data transfer method

The module enables flexible serial data transfer. An operational data transfer method can be set by the module's parameters.

The data transfer can be parameterized as follows:

- Data rate: 300 bps to 115200 bps
- Data bits: 7 or 8 data bits in one data frame
- Parity: none, odd or even
- Stop bits: 1 or 2 bit.

NOTE

The data flow control can be realized via a hardware handshake (RTS/CTS) or a software handshake (XON/XOFF).

12.1.2 Data exchange

For the data exchange with a field device, the RS232-module provides a 64-byte transmit-buffer and a 128-byte receive-buffer. This is a hardware-restriction. The data telegrams which have to be sent or received can be larger.

The data transfer from the PLC into the transmit-buffer of the RS232-module or from the receive-buffer of the module to the PLC is realized via a 8-byte transmission channel in the process output or process input data.
To ensure the error-free data transmission, 2 byte of each data package are used to display status-, control- and diagnosis information. The amount of user data is therefore reduced to 6 byte within a data package

12.1.3 Process data

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master.

With DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT (PACTware™ + BL67-DTM).

Process input data

The RS232-module sends the data, received by the device, into a 128-byte receive-buffer. The module then transmits the data segmented via the module bus and the gateway to the PLC.

The transmission is realized in a 8-byte format which is structured as follows:

- 1 status byte is required to ensure trouble-free transmission of the data.
- 1 byte contains the diagnostics data.
- 6 bytes are used to contain the user data.

Byte	Byte DP/PN	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
		Status byte							
n	n + 7	STAT	TX_CNT_ACK		RX_CNT		RX_BYTE_CNT		
		Diagnostic message							
n + 1	n + 6	Buf_ Ovfl	Frame_ ERR	HndSh_ ERR	HW_ Fail	PRM_ ERR	reserved		TXBufNo-tEmpty
		Data bytes							
n + 2	n + 5	RX_data byte 0							
n + 3	n + 4	RX_data byte 1							
n + 4	n + 3	RX_data byte 2							
n + 5	n + 2	RX_data byte 3							
n + 6	n + 1	RX_data byte 4							
n + 7	n	RX_data byte 5							

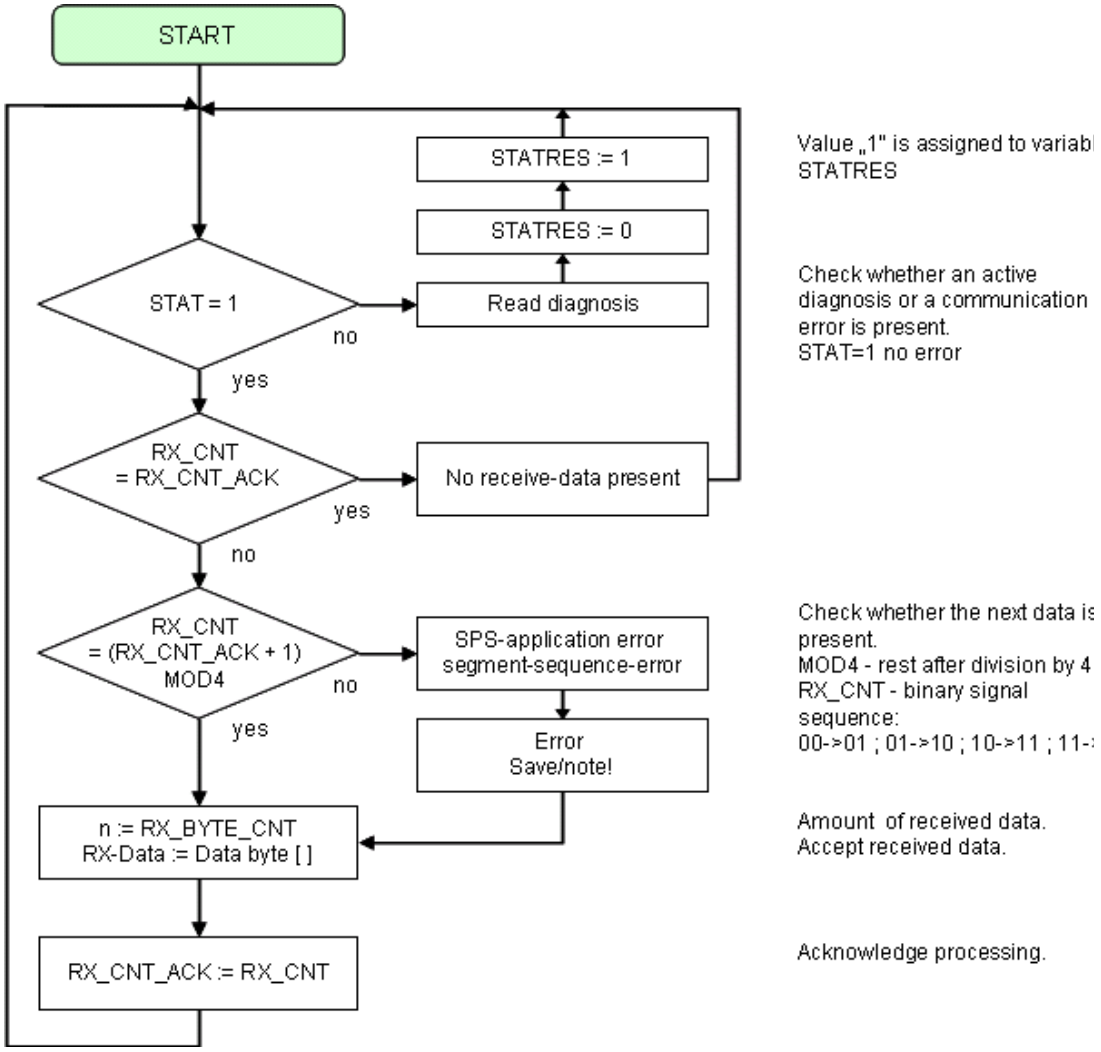
n = offset of input data; depending on extension of station and the corresponding fieldbus.

Table 12-1: Process input data

Designation	Value	Description
RX_BYTE_CNT	0-7	Number of the valid bytes in this data segment.
RX_CNT	0-3	The value RX_CNT is transferred together with every data segment of the process input data. The RX_CNT values are sequential: 00->01->10->11->00… (decimal: 0->1->2->3->0…) Errors in this sequence show the loss of data segments.
TX_CNT_ACK	0-3	The value TX_CNT_ACK is a copy of the value TX_CNT. The value TX_CNT was transferred together with the last data segment of the process output data. The value TX_CNT_ACK is a confirmation of successful acceptance of the data segment using TX_CNT.
STAT	0-1	1: The communication with the data terminal equipment (DTE) is not disturbed. 0: The communication with the data terminal equipment (DTE) is disturbed. A diagnostic message is generated, if the parameter "Deactivate diagnostics" is set to "no". The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES.
TXBufNotEmpty	0-1	This bit signalizes that the transmit buffer still contains data. It is automatically reset when the last character is sent from the send buffer. The bit can be used as control bit for actively triggering the sending of the TX data buffer.
BufOvfl; FrameErr; HndShErr; HwFailure; PrmErr	0 - 255	Diagnostic information (correspond to the diagnostic information in the diagnosis telegram, see Diagnostic data, page 12-12). These diagnostics are always displayed and independent to the setting of the parameter "Diagnostics".

Schematic diagram of the receive sequence

Figure 12-1: Schematic diagram of the receive sequence



Process output data

The data received from the PLC are loaded into the 64-bit transmit-buffer in the module.

The transmission is realized in a 8-byte format which is structured as follows:

- 1 control byte is required to ensure trouble-free transmission of the data.
- 1 byte contains, signals to start the flushing of transmit- and receive buffer.
- 6 bytes are used to contain the user data.

Byte	Byte DP/PN	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
		Control byte							
n	n + 7	STATRES	RX_CNT_ACK		TX_CNT		TX_BYTE_CNT		
		Flushing of receive- or transmit-buffer							
n + 1	n + 6	reserved					TXBuf Dis	RXBUF FLUSH	TXBUF FLUSH
		Data bytes							
n + 2	n + 5	TX_data byte 0							
n + 3	n + 4	TX_data byte 1							
n + 4	n + 3	TX_data byte 2							
n + 5	n + 2	TX_data byte 3							
n + 6	n + 1	TX_data byte 4							
n + 7	n	TX_data byte 5							

n = offset of output data; depending on extension of station and the corresponding fieldbus.

Meaning of the data bits (process output)

Table 12-2: Process output data

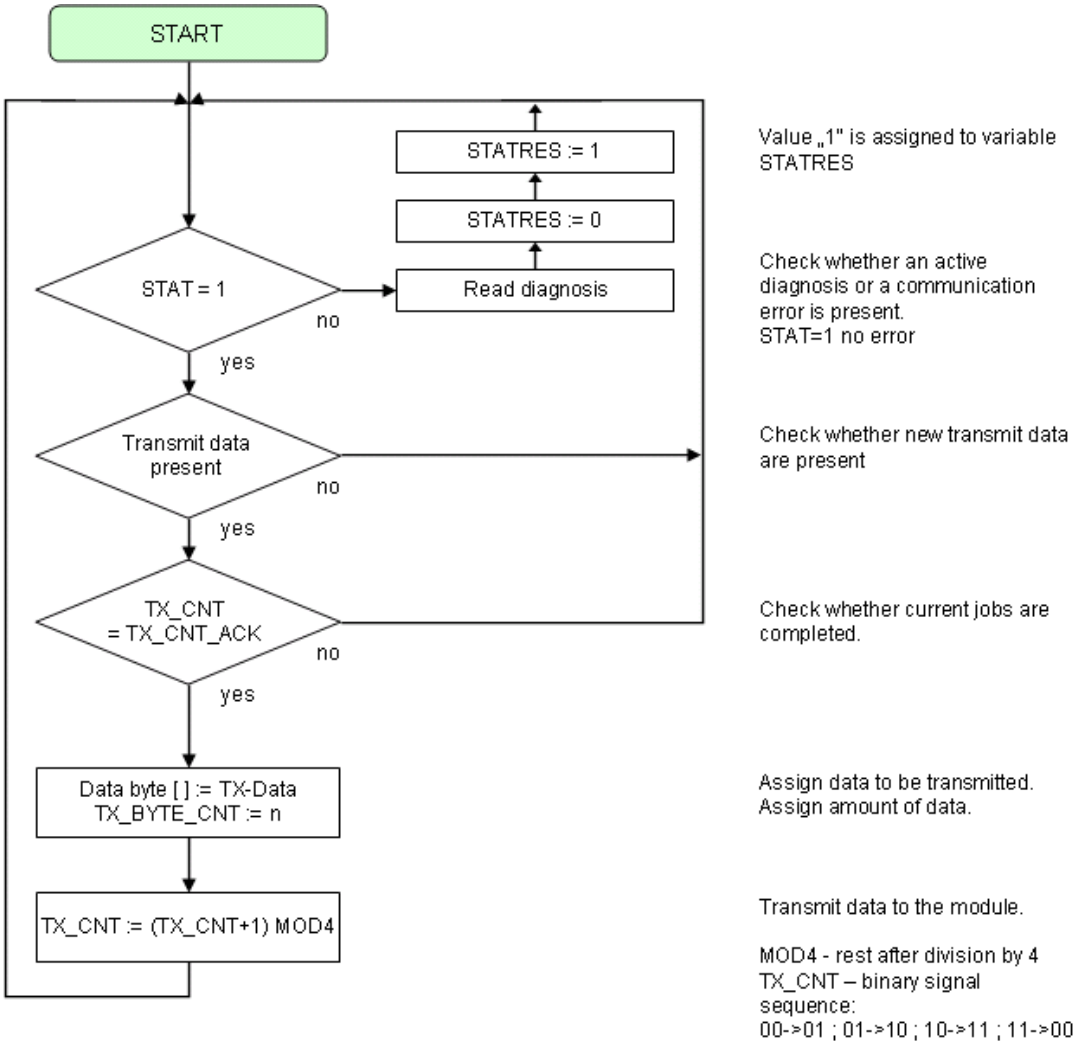
Designation	Value	Description
TX_BYTE_CNT	0 - 7	Number of the valid bytes in this data segment.
TX_CNT	0-3	This value is transferred together with every data segment. The TX_CNT values are sequential: 00->01->10->11->00… (decimal: 0->1->2->3->0…) Errors in this sequence show the loss of data segments.
RX_CNT_ACK	0-3	The value RX_CNT_ACK is a copy of the value RX_CNT. The value RX_CNT was transferred together with the last data segment of the process input data. RX_CNT_ACK has to be set analog to RX_CNT (in the status byte). RX_CNT_ACK is an acknowledge for the successful transmission of the data segment with RX_CNT. New data can now be received.

Table 12-2: Process output data

Designation	Value	Description
STATRES	0-1	This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the STAT bit is reset (from 0 to 1). If this bit is 0, all changes in TX_BYTE_CNT, TX_CNT and RX_CNT_ACK are ignored. The clearing of the receive and transmit buffer by RXBUF FLUSH/TXBUF FLUSH is possible. The value 1 or the transition from 0 to 1 disables the clearing of the receive and transmit buffer by the RXBUF FLUSH/TXBUF FLUSH.
RXBUF FLUSH	0 - 1	The RXBUF FLUSH bit is used for clearing the receive buffer. If STATRES = 1: A request with RXBUF FLUSH = 1 will be ignored. If STATRES = 0: RXBUF FLUSH = 1 will clear the receive buffer.
TXBUF FLUSH	0-1	The TXBUF FLUSH bit is used for clearing the transmit buffer. If STATRES = 1: A request with TXBUF FLUSH = 1 will be ignored. If STATRES = 0: TXBUF FLUSH = 1 will clear the transmit buffer.
TXBufDis	0-1	Setting this bit deactivates the sending of the TX buffer. The bit can be used as control bit for actively triggering the sending of the TX data buffer.

Schematic diagram of the transmit sequence

Figure 12-2: Schematic diagram of the transmit sequence



12.1.4 Technical data

Figure 12-3:
RS232 module

Figure 12-4:
Block diagram

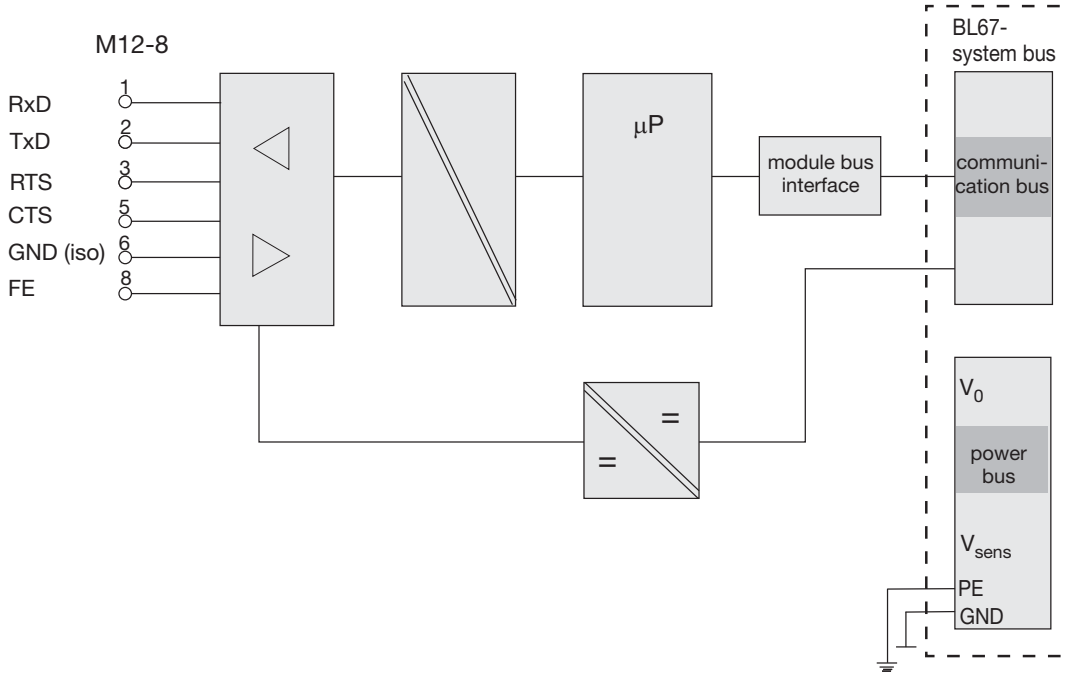


Table 12-3: Technical data

Designation	BL67-1RS232
Number of channels	1
Power supply	vie module bus
Voltage from module bus U_{MB}	5 VDC
Permissible range	4.75 to 5.25 VDC
Field supply	24 VDC
Permissible range	18 to 30 VDC
Nominal current consumption at 5 VDC (module bus) I_{MB}	≤ 140 mA
Data buffer	128 byte receive buffer 64 byte transmit buffer
Transmission level active (U_{RS1})	-15 to -3 V
Transmission level inactive (U_{RS0})	3 to 15 V
Transmission channels	TxD and RxD, full duplex
Transmission rate	max. 115200 baud (parameterizable)
RS232 cable length	max. 15 m
Data flow control	software handshake (Xon/Xoff) hardware handshake (RTS/CTS)
Diagnostic data can be written into the process image (depending on the parameterization)	
Isolation voltage	
U_{TMB} (module bus/RS232)	max. 1000 VDC
U_{field} (field voltage/RS232)	max. 1000 VDC

12.1.5 Diagnostic and status messages

LED status messages

Table 12-4: LED status messages

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	Red flashing, 0.5 Hz	Diagnostic message pending	–
	off	No error messages or diagnostics	–
TxD	Green	Data transmission active	-
	off	No data transmission	-
RxD	Green	Data are currently received	-
	off	No data are received	-
RTS	Green	The RS232 module stopped the data transfer from the communication partner.	-
	off	The RS232 module enabled the data transfer from the communication partner.	-
CTS	Green	The communication partner stopped the data transfer from the RS232 module.	-
	off	The communication partner enabled the data transfer from the RS232 module.	-

Diagnostic data

This module has the following diagnostic data per channel:

Diagnostic byte assignment, Process input data (page 12-3)

Table 12-5: Diagnostic message

Diagnostics	Meaning
buffer overflow	Buff Ovfl: Overflow of the receive-buffer (RX-buffer).
Frame error	Frame Err: The module has to be parameterized for adaptation to the data structure of the data terminal equipment (DTE). A frame error occurs in case of inconsequent parameterization (number of data bits, stop bits, method of parity, …).
Data flow control error Data flow control	HndSh Err: The DTE connected t the module does not react to XOFF or RTS handshake. The internal receive-buffer may overflow (buffer-overflow = 1).
Hardware error	HW Faliure: The module has to be replaced (e.g. error in EEPROM or UART)
Parameterization error	Prm Err: The parameter settings can not be supported.

12.1.6 Module parameters

Standard				PROFIBUS PROFINET		Parameter
byte-oriented		word-oriented				
Byte 0	Bit 0	Word 0	Bit 0	Byte 3	Bit 0	Transmission rate
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	reserved
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	Extended status/control mode
	Bit 7		Bit 7		Bit 7	Deactivate diagnostics
Byte 1	Bit 0		Bit 8	Byte 2	Bit 0	Stop bits
	Bit 1		Bit 9		Bit 1	Parity bit
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	Data bits
	Bit 4		Bit 12		Bit 4	Data flow control
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	reserved
	Bit 7		Bit 15		Bit 7	
Byte 2	Bit 0	Word 1	Bit 0	Byte 1	Bit 0	XON character
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 3	Bit 0		Bit 8	Byte 0	Bit 0	XOFF character
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	

Table 13: Module parameters

A *Default setting*

Parameter name	Value	Meaning
transmission rate	300 bps 600 bps 1200 bps 2400 bps 4800 bps 9600 bps **A** 14400 bps 19200 bps 28800 bps 38400 bps 57600 bps 115200 bps	
Extended status/control mode	0 = no 1 = yes **A**	If the Extended status/control mode is activated, the diagnostic messages are mapped into byte 6 of the process input data (independent of parameter "deactivate diagnostics"). Byte 6 of the process output data contains two bits which may be set to flush the transmit- or the receive-buffer. Byte 7 contains the status or control byte. User data are represented in Bytes 0 - 5.
Deactivate diagnostics	0 =no **A** 1 = yes	Sending of diagnostics activated/deactivated: This affects the separate fieldbus-specific diagnostic message – not the diagnosis embedded in the process input data.
Stop bits	0 = 1	Number of stop bits.
	1 = 2 **A**	
Parity bit	00 = none	
	01 = odd **A**	The parity bit is set so that the total number of bits (data bits plus parity bit) set to 1 is odd.
	10 = even	The parity bit is set so that the total number of bits (data bits plus parity bit) set to 1 is even.
Data bits	0 = 7 **A**	The number of data bits is 7.
	1 = 8	The number of data bits is 8.
Data flow control	00 = none **A**	Data flow control is switched off.
	01 = XON/XOFF	Software handshake Software handshake (XON/XOFF) is switched on.
	10 = RTS/CTS	Hardware handshake Hardware handshake (RTS/CTS) is switched on.

Table 13: Module parameters

A *Default setting*

Parameter name	Value	Meaning
XON character	0 - 255 (17 **A)**	XON character This character is used to start the transmission of data from the data terminal device if the software handshake is active.
XOFF character	0 - 255 (19 **A)**	XOFF character This character is used to stop the transmission of data from the data terminal device if the software handshake is active.

12.1.7 Base modules/pin assignment

- BL67-B-1M12/BL67-B-1M12-8

Figure 12-5: BL67-B-1M12-8/ BL67-B-1M12

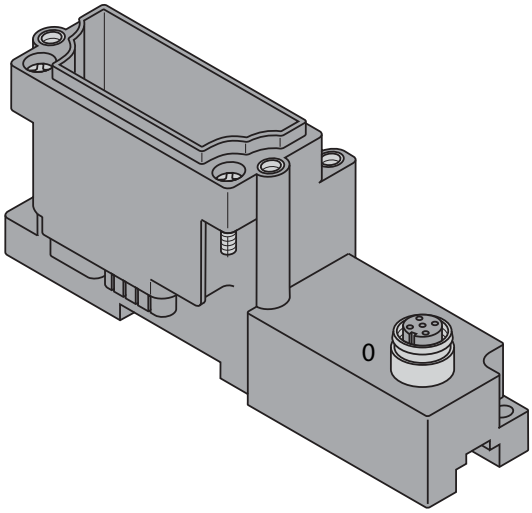
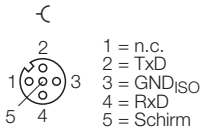
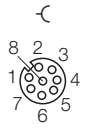


Figure 12-6: Pin assignment BL67-1RS232 with BL67-B-1M12



1 = n.c.
2 = TxD
3 = GND_{ISO}
4 = RxD
5 = Schirm

Figure 12-7: Pin assignment BL67-1RS232 with BL67-B-1M12-8



1 = RxD
2 = TxD
3 = RTS
4 = CTS
5 = GND_{ISO}
6 = n.c.
7 = n.c.
8 = Schirm

- BL67-B-1M23/BL67-B-1M23-VI

Figure 12-8: BL67-B-1M23/ BL67-1M23-VI

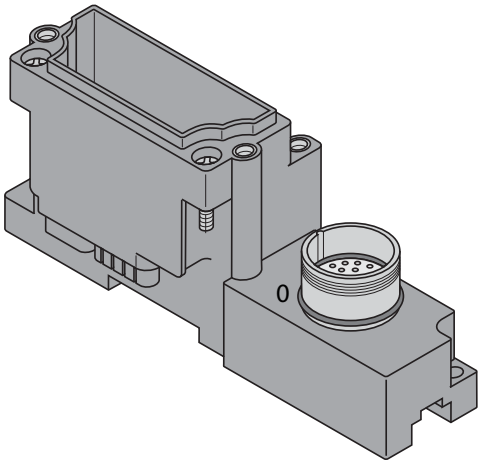


Figure 12-9:
Pin assignment
BL67-1RS232 with
BL67-B-1M23

Figure 12-10:
Pin assignment
BL67-1RS232 with
BL67-1M23-VI

12.2 BL67-1RS485/422

The module BL67-1RS485/422 allows the transfer of serial data streams via the RS485/422 interface and therefore enables various devices to be connected, such as printers, scanners or bar code readers that use the RS485/422 interface for communication. The interface transfers the data received from the device to the PLC or transfers data to be sent from the PLC to the device.

12.2.1 Data transfer method

The module enables flexible serial data transfer. The RS422 connection mode supports two wire simplex or four wire full-duplex transmission. The RS485 connection supports two wire half-duplex transmission.

An operational data transfer method can be set by the module's parameters.

The data transfer can be parameterized as follows:

- Data rate: 300 bps to 115200 bps
- Data bits: 7 or 8 data bits in one data frame
- Parity: none, odd or even
- Stop bits: 1 or 2 bit.

The data flow control can be implemented in RS422 operation with a software handshake (XON/XOFF) routine.

12.2.2 Data exchange

For the data exchange with a field device, the module provides a 64-byte transmit-buffer and a 128-byte receive-buffer. This is a hardware-restriction. The data telegrams which have to be sent or received can be larger.

The data transfer from the PLC into the transmit-buffer of the module or from the receive-buffer of the RS485/422 module to the PLC is realized via a 8-byte transmission channel in the process output or process input data.

To ensure the error-free data transmission, 2 byte of each data package are used to display status-, control- and diagnosis information. The amount of user data is therefore reduced to 6 byte within a data package

12.2.3 Process data

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master.

With DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT (PACTware™ + BL67-DTM).

Process input data

The RS485/422-module sends the data, received by the device, into a 128-byte receive-buffer. The module then transmits the data segmented via the module bus and the gateway to the SPS.

The transmission is realized in a 8-byte format which is structured as follows:

- 1 status byte is required to ensure trouble-free transmission of the data.
- 1 byte contains the diagnostics data.
- 6 bytes are used to contain the user data.

Byte	Byte DP/PN	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
		Status byte							
n	n + 7	STAT	TX_CNT_ACK		RX_CNT		RX_BYTE_CNT		
		Diagnostic message							
n + 1	n + 6	Buf_ Ovfl	Frame_ ERR	HndSh_ ERR	HW_ Fail	PRM_ ERR	reserved		TXBufNo-tEmpty
		Data bytes							
n + 2	n + 5	RX_data byte 0							
n + 3	n + 4	RX_data byte 1							
n + 4	n + 3	RX_data byte 2							
n + 5	n + 2	RX_data byte 3							
n + 6	n + 1	RX_data byte 4							
n + 7	n	RX_data byte 5							

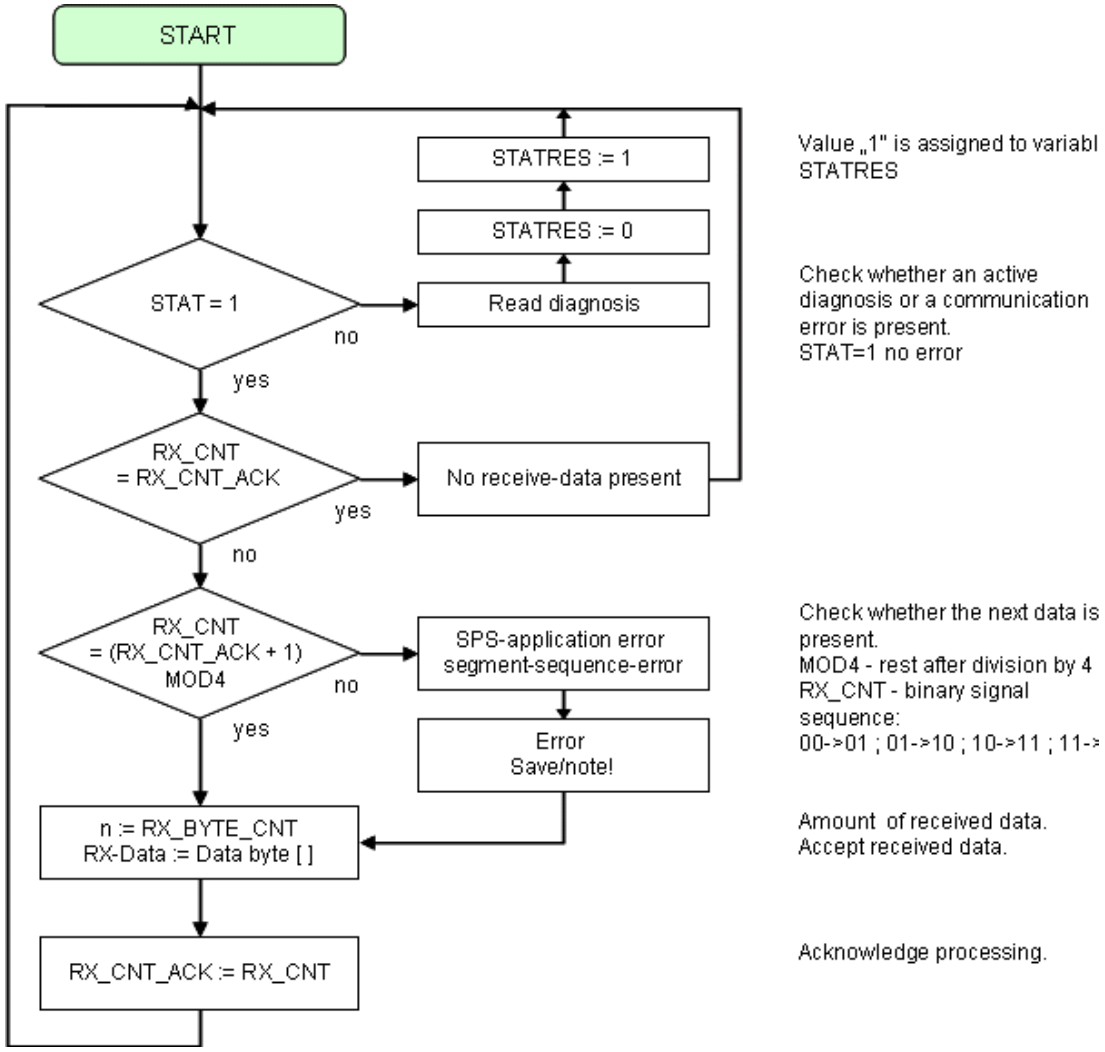
n = offset of input data; depending on extension of station and the corresponding fieldbus.

Table 12-1: Process input data

Designation	Value	Description
RX_BYTE_CNT	0-7	Number of the valid bytes in this data segment.
RX_CNT	0-3	This value is transferred together with every data segment. The RX_CNT values are sequential: 00 → 01 → 10 → 11 → 00… (decimal: 0 → 1 → 2 → 3 → 0…) Errors in this sequence show the loss of data segments.
TX_CNT_ACK	0-3	The value TX_CNT_ACK is a copy of the value TX_CNT. The value TX_CNT was transferred together with the last data segment of the process output data. The value TX_CNT_ACK is a confirmation of successful acceptance of the data segment using TX_CNT.
STAT	0-1	1: The communication with the data terminal equipment (DTE) is not disturbed. 0: The communication with the data terminal equipment (DTE) is disturbed. A diagnostic message is generated, if the parameter "Deactivate diagnostics" is set to "no". The diagnostic data show the cause of the communication disturbance. The user has to set back this bit in the process output data by using STATRES.
TXBufNotEmpty	0-1	This bit signalizes that the transmit buffer still contains data. It is automatically reset when the last character is sent from the send buffer. The bit can be used as control bit for actively triggering the sending of the TX data buffer.
BufOvfl; FrameErr; HndShErr; HwFailure; PrmErr	0 - 255	Diagnostic information (correspond to the diagnostic information in the diagnosis telegram). These diagnostics are always displayed and independent to the setting of the parameter "Deactivate diagnostics".

Schematic diagram of the receive sequence

Figure 12-11: Schematic diagram of the receive sequence



Process output data

The data received from the PLC are loaded into the 64-bit transmit-buffer in the module.

The transmission is realized in a 8-byte format which is structured as follows:

- 1 control byte is required to ensure trouble-free transmission of the data.
- 1 byte contains, signals to start the flushing of transmit- and receive buffer.
- 6 bytes are used to contain the user data.

Byte	Byte DP/PN	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
		Control byte							
n	n + 7	STATRES	RX_CNT_ACK		TX_CNT		TX_BYTE_CNT		
		Flushing of receive- or transmit-buffer							
n + 1	n + 6	reserved					TXBufDis	RXBUF FLUSH	TXBUF FLUSH
		Data bytes							
n + 2	n + 5	TX_data byte 0							
n + 3	n + 4	TX_data byte 1							
n + 4	n + 3	TX_data byte 2							
n + 5	n + 2	TX_data byte 3							
n + 6	n + 1	TX_data byte 4							
n + 7	n	TX_data byte 5							

n = offset of output data; depending on extension of station and the corresponding fieldbus.

Table 12-2: Process output data

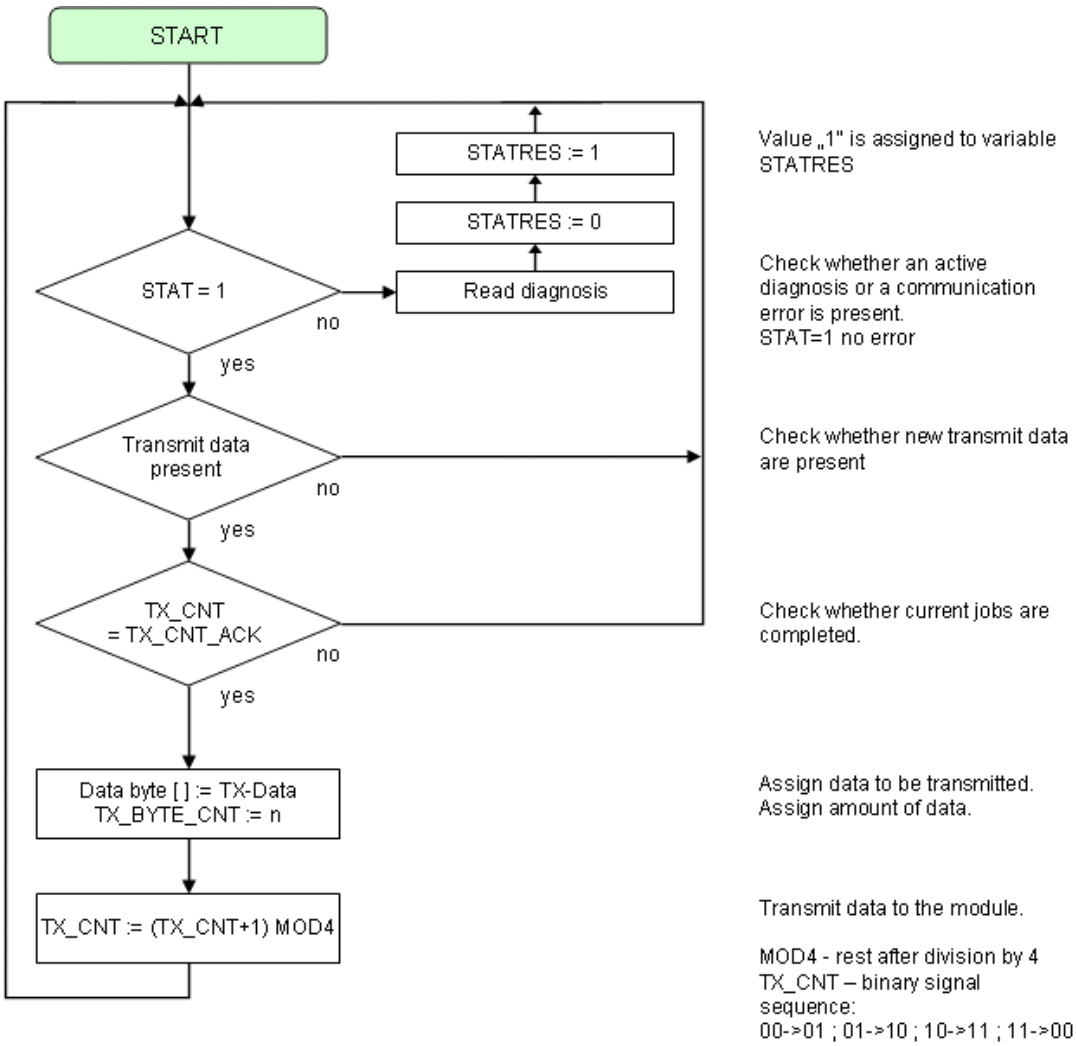
Designation	Value	Description
TX_BYTE_CNT	0 - 7	Number of the valid bytes in this data segment.
TX_CNT	0 - 3	This value is transferred together with every data segment. The TX_CNT values are sequential: 00 → 01 → 10 → 11 → 00… (decimal: 0 → 1 → 2 → 3 → 0…) Errors in this sequence show the loss of data segments.
RX_CNT_ACK	0 - 3	The value TX_CNT_ACK is a copy of the value TX_CNT. The value RX_CNT was transferred together with the last data segment of the process input data. The value TX_CNT_ACK is a confirmation of successful acceptance of the data segment using TX_CNT.
STATRES	0 - 1	This bit is set to reset the STAT bit in the process input data. With the change from 1 to 0 the STAT bit is reset (from 0 to 1). The clearing of the receive and transmit buffer by RXBUF FLUSH/TXBUF FLUSH is possible. If this bit is 0, all changes in TX_BYTE_CNT, TX_CNT and RX_CNT_ACK are ignored. The value 1.0 or the transition from 0 to 1 disables the clearing of the receive and transmit buffer by the RXBUF FLUSH/TXBUF FLUSH.

Table 12-2: Process output data

Designation	Value	Description
RXBUF FLUSH	0 - 1	The RXBUF FLUSH bit is used for clearing the receive buffer. If STATRES = 0,1 or 0 → 1: A request with RXBUF FLUSH = 1 will be ignored. If RXBUF FLUSH = 1, a rising edge 1 →0 at STATRES clears the receive buffer.
TXBUF FLUSH	0-1	The TXBUF FLUSH bit is used for clearing the transmit buffer. If STATRES = 0, 1 or 0 →1: A request with TXBUF FLUSH = 1 will be ignored. If TXBUF FLUSH = 1, a falling edge 1 → 0 at STATRES clears the transmit buffer.
TXBufDis	0-1	Setting this bit deactivates the sending of the TX buffer. The bit can be used as control bit for actively triggering the sending of the TX data buffer.

Schematic diagram of the transmit sequence

Figure 12-12: Schematic diagram of the transmit sequence



12.2.4 Technical data

Figure 12-13:
Electronic module
BL67-1RS485/422

Figure 12-14:
Block diagram
BL67-1RS485/422

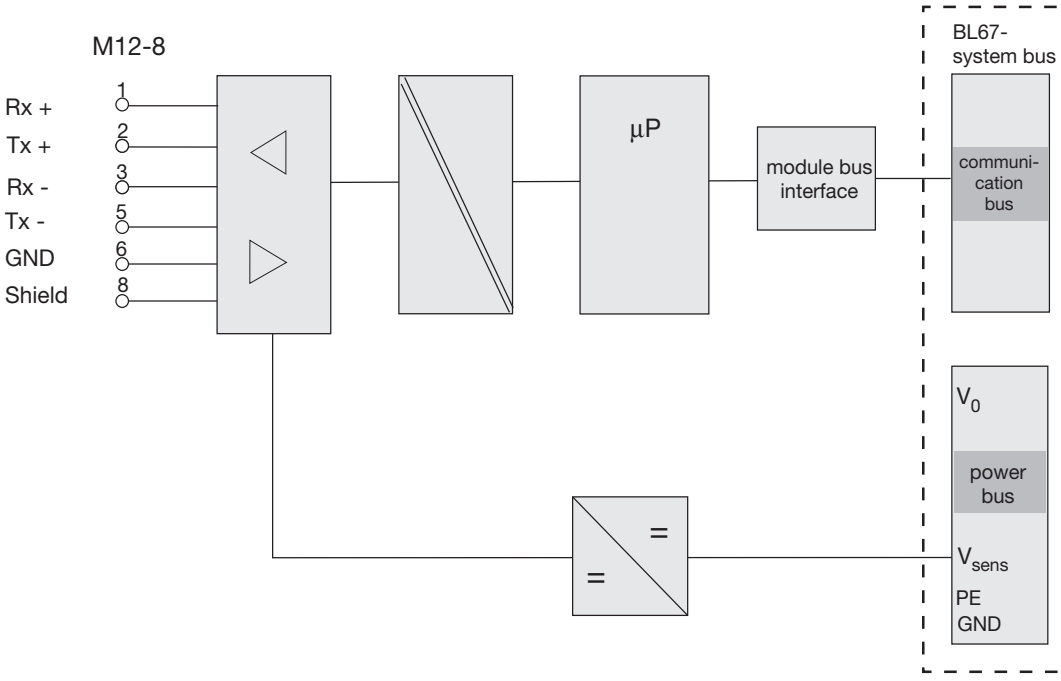


Table 12-3: Technical data BL67-1RS485/422

Designation	BL67-1RS485/422
Number of RS485/422 interfaces	1
Nominal voltage from supply terminal	18 to 30 VDC
Nominal current from supply terminal (field) I_L	25 mA
Voltage from module bus	4.75 to 5.25 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	60 mA
Transmission channels	RxD, TxD
Data buffer	
Receive buffer	128 byte
Transmit buffer	64 byte
RS422 connection type	Two wire simplex or four wire full-duplex
RS485 connection type	Two wire half-duplex
Bit transmission rate	max. 115200 Bit/s (parameterizable)
Transmission level active (U_{RS1})	min. 500 mV
Transmission level inactive (U_{RS0})	max. 200 mV
Common mode (U_{GL})	-7 to 12 V
RS485/422 cable length	max. 30 m
Cable impedance	120 Ω
Bus terminating resistors	120 Ω (external)
Isolation voltage	
U_{TMB} (module bus/field voltage/RS485)	max. 1000 VDC
U_{field} (field voltage/RS485)	0 V

12.2.5 Diagnostic and status messages

LED status messages

Table 12-4: LED status messages

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	off	No error messages or diagnostics	–
TxD	Green	Data transmission active	–
	off	No data transmission	–
RxD	Green	Data are currently received	–
	off	No data are received	–

Diagnostics

This module has the following diagnostic data per channel:

Diagnostic byte assignment, Process input data (page 12-18)

Table 12-5: Diagnostics

Diagnostic message	
buffer overflow	Buff Ovfl: Overflow of the receive-buffer (RX-buffer).
Frame error	Frame Err: The module has to be parameterized for adaptation to the data structure of the data terminal equipment (DTE). A frame error occurs in case of inconsequent parameterization (number of data bits, stop bits, method of parity, …).
Data flow control error Data flow control	HndSh Err: The DTE connected t the module does not react to XOFF or RTS handshake. The internal receive-buffer may overflow (buffer-overflow = 1).
Hardware error	HW Faliure: The module has to be replaced (e.g. error in EEPROM or UART)
Parameterization error	Prm Err: The parameter settings can not be supported.

12.2.6 Module parameters

Standard				PROFIBUS PROFINET		Parameter
byte-oriented		word-oriented				
Byte 0	Bit 0	Word 0	Bit 0	Byte 3	Bit 0	Transmission rate
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	RS422/RS485
	Bit 5		Bit 5		Bit 5	reserved
	Bit 6		Bit 6		Bit 6	Extended status/control mode
	Bit 7		Bit 7		Bit 7	Deactivate diagnostics
Byte 1	Bit 0		Bit 8	Byte 2	Bit 0	Stop bits
	Bit 1		Bit 9		Bit 1	Parity bit
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	Data bits
	Bit 4		Bit 12		Bit 4	Data flow control
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	reserved
	Bit 7		Bit 15		Bit 7	
Byte 2	Bit 0	Word 1	Bit 0	Byte 1	Bit 0	XON character
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 3	Bit 0		Bit 8	Byte 0	Bit 0	XOFF character
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	

Table 13: Module parameters

A *Default setting*

Parameter name	Value	Meaning
transmission rate	0000 = 300 bps 0001 = 600 bps 0010 = 1200 bps 0100 = 2400 bps 0101 = 4800 bps 0110 = 9600 bps **A** 0111 = 14400 bps 1000 = 19200 bps 1001 = 28800 bps 1010 = 38400 bps 1011 = 57600 bps 1100 = 115200 bps	
RS422/RS485	0 = RS422 1 = RS485	Parameterization of the module as RS422 or RS485-interface.
Extended status/control mode	0 = no 1 = yes **A**	If the Extended status/control mode is activated, the diagnostic messages are mapped into byte 6 of the process input data (independent of parameter "deactivate diagnostics"). Byte 6 of the process output data contains two bits which may be set to flush the transmit- or the receive-buffer. Byte 7 contains the status or control byte. User data are represented in Bytes 0 - 5.
Deactivate diagnostics	0 =no **A** 1 = yes	Sending of diagnostics activated/deactivated: This affects the separate fieldbus-specific diagnostic message – not the diagnosis embedded in the process input data.
Stop bits	0 = 1	Number of stop bits.
	1 = 2 **A**	
Parity bit	00 = none	
	01 = odd **A**	The parity bit is set so that the total number of bits (data bits plus parity bit) set to 1 is odd.
	10 = even	The parity bit is set so that the total number of bits (data bits plus parity bit) set to 1 is even.
Data bits	0 = 7 **A**	The number of data bits is 7.
	1 = 8	The number of data bits is 8.
Data flow control	00 = none	The data flow control is switched off.
	01 = XON/XOFF	Software handshake (XON/XOFF) is switched on.

Table 13: Module parameters

A *Default setting*

Parameter name	Value	Meaning
XON character (RS422)	0 - 255 (17 A)	XON character This character is used to start the transmission of data from the data terminal device if the software handshake is active.
XOFF character (RS422)	0 - 255 (19 A)	XOFF character This character is used to stop the transmission of data from the data terminal device if the software handshake is active.

12.2.7 Base modules/pin assignment

- BL67-B-1M12/BL67-B-1M12-8

Figure 12-15: BL67-B-1M12-8/ BL67-B-1M12

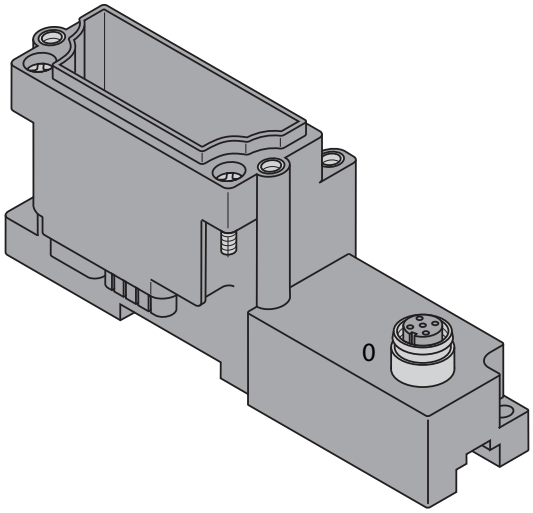
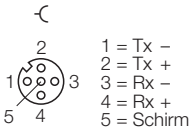


Figure 12-16: pin assignment BL67-1RS485/422 with BL67-B-1M12



1 = Tx –
2 = Tx +
3 = Rx –
4 = Rx +
5 = Schirm

Figure 12-17: pin assignment BL67-1RS485/422 with BL67-B-1M12-8

1 = Rx +
2 = Tx +
3 = Tx –
4 = n.c.
5 = Rx –
6 = GND_{ISO}
7 = n.c.
8 = Schirm

- BL67-B-1M23/BL67-B-1M23-VI

Figure 12-18: BL67-B-1M23/ BL67-B-1M23-VI

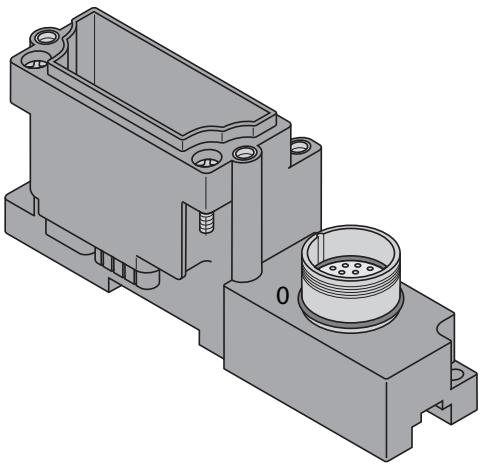


Figure 12-19: pin assignment BL67-1RS485/422 with BL67-B-1M23

1 = Rx +	7 = n.c.
2 = Tx +	8 = shield
3 = Tx –	9 = n.c.
4 = n.c.	10 = n.c.
5 = Rx –	11 = Tx –
6 = GND (iso)	12 = n.c.

Figure 12-20: pin assignment BL67-1RS485/422 with BL67-B-1M23-VI

1 = Rx +	7 = n.c.
2 = Tx +	8 = Schirm
3 = Tx –	9 = V_{SENS}
4 = n.c.	10 = V_{SENS}
5 = Rx –	11 = V_{SENS}
6 = GND (iso)	12 = GND

12.3 BL67-1SSI

The BL67-1SSI module is used for connecting SSI encoders with a maximum word length of 32 bits and a maximum bit transmission rate of 1 Mbps. It provides a 24 VDC (500 mA) power supply. In order to read SSI encoder data, the BL67-1SSI module outputs a clock signal with which the encoder value can be read via the signal input. The clock signal and the signal input are based on the RS422 protocol.

12.3.1 Data transfer method

The BL67-1SSI module enables the SSI data to be transferred according to the requirements of the application. An operational data transfer method can be set by the module's parameters.

- Gray code or binary code data transmission is possible.
- Bit transmission rates from 62.5 kbps to 1 Mbps are possible.

The SSI encoder value can be represented in a data frame with between 1 to 32 bits. Bits can be deactivated at both the LSB and MSB side of the frame. At the MSB side this is done by a masking operation, which causes invalid bits to be set to 0. At the LSB side, the invalid bits are removed by shifting the entire data frame to the right. The missing bits on the MSB side are filled with zeros.

12.3.2 Data exchange

The data transfer between the PLC to the SSI-module is cyclic. The cyclic data transfer from the PLC to the SSI-module is done via the process output data, the cyclic data transfer from the SSI-module to the PLC via the process input data.

The process output data is used for writing the registers and requesting data from them. It is possible to stop the communication with the SSI encoder and activate or deactivate comparison operations.

The process input data is used for reading the contents of the registers inside the modules. In this case, the SSI encoder value is part of the register. The writing of these registers can be controlled. The results of different comparison operations can be supplied, and the communication status with the SSI encoder can also be displayed. Status messages that were generated by the connected SSI encoder can be passed to the PLC as process input data.

The diagnostics messages are also embedded in the process input data.

The parameter and diagnostics interface allows acyclic data to be transferred in addition to this cyclic data. The parameters for the data transmission on the SSI module, such as bit transmission rate, telegram length etc. are set via the parameter interface. The diagnostics interface supplies the higher level system with error messages, such as parameter errors.

Process data

With PROFIBUS, PROFINET and CANopen, the I/O data of this module is localized within the process data of the whole station via the hardware configuration tool of the fieldbus master.

With DeviceNet™, EtherNet/IP™ and Modbus TCP a detailed mapping table can be created with the TURCK configuration tool I/O-ASSISTANT (PACTware™ + BL67-DTM).

Process input data (PZDE)

The field input data is transferred from the connected field device to BL67-1SSI-module.

The process input data is the data that is transferred by the BL67-1SSI-module via a gateway to the PLC.

The transmission is realized in a 8-byte format which is structured as follows:

- 4 bytes are used for representing the data that was read from the register with the address stated at REG_RD_ADR.

- When necessary, 1 byte represents the register address of the read data and an acknowledgment that the read operation was successful.
- 1 byte can be used to transfer status messages of the SSI encoder. This byte also contains an acknowledgment that the write operation to the register was successful and indication of an active write operation.
- 1 byte contains the results of comparison operations with the SSI encoder value.
- 1 byte contains messages concerning the communication status between the BL67-1SSI module and the SSI encoder, as well as other results of comparison operations.

The following table describes the structure of the 8 x 8 bits of the process input data. STS (or ERR) contains non-retentive status information, i.e. the bit concerned indicates the actual status.

FLAG describes a retentive flag that is set in the event of a particular event. The bit concerned retains the value until it is reset.

Byte	Byte DP/PN	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
		Diagnostic message							
n	n + 7	STS_ STOP	-	-	ERR_ PARA	STS_ UFLW	STS_ OFLW	ERR_ SSI	SSI_DI AG
		Status messages SSI							
n + 1	n + 6	STS_UP	STS_DN	REL_ CMP2	FLAG CMP2	STS_ CMP2	REL_ CMP1	FLAG CMP1	STS_ CMP1
n + 2	n + 5	REG_WR_ ACEPT	REG_WR_ AKN	-	-	SSI_STS3	SSI_STS2	SSI_STS1	SSI_STS0
n + 3	n + 4	REG_RD_ ABORT	-	REG_RD_ADR					
		Data bytes							
n + 4	n + 3	REG_RD_DATA, data byte 0							
n + 5	n + 2	REG_RD_DATA, data byte 1							
n + 6	n + 1	REG_RD_DATA, data byte 2							
n + 7	n	REG_RD_DATA, data byte 3							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

Meaning of the data bits (process input)

Table 12-1: Meaning of the data bits (process input)

Designation	Value	Description
STS_STOP	0	The SSI encoder is read cyclically.
	1	Communication with the SSI encoder is stopped as STOP = 1 (process output) or ERR_PARA = 1.
ERR_PARA	0	The parameter set of the module has been accepted.
	1	Operation of the module is not possible with the present parameter set.

Table 12-1: Meaning of the data bits (process input)

Designation	Value	Description
STS_UFLW	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≥ (REG_LOWER_LIMIT)
	1	A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_LOWER_LIMIT)
STS_OFLW	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≤ (REG_UPPER_LIMIT)
	1	A comparison of the register contents has produced the following result: (REG_SSI_POS) > (REG_UPPER_LIMIT)
ERR_SSI	0	SSI encoder signal present.
	1	SSI encoder signal faulty (e.g. due to a cable break).
SSI_DIAG	0	No enabled status signal is active (SSI_STSx = 0).
	1	At least one enabled status signal is active (SSI_STSx = 1)
STS_UP (LED UP)	0	The SSI encoder values are decremented or the values are constant.
	1	The SSI encoder values are incremented.
STS_DN (LED DN)	0	The SSI encoder values are incremented or the values are constant.
	1	The SSI encoder values are decremented.
REL_CMP2	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP2)
	1	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≥ (REG_CMP2)
FLAG_CMP2	0	Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP2) since the last reset.
	1	The contents of the registers match (REG_SSI_POS) = (REG_CMP2). This marker must be reset with CLR_CMP2 = 1 in the process output data.
STS_CMP2	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP2)
	1	A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP2)

Table 12-1: Meaning of the data bits (process input)

Designation	Value	Description
REL_CMP1	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) < (REG_CMP1)
	1	A comparison of the register contents has produced the following result: (REG_ SSI_POS) ≥ (REG_CMP1)
FLAG_CMP1	0	Default status, i.e. the register contents have not yet matched (REG_SSI_POS) = (REG_CMP1) since the last reset.
	1	The contents of the registers match (REG_SSI_POS) = (REG_CMP1). This marker must be reset with CLR_CMP1 = 1 in the process output data.
STS_CMP1	0	A comparison of the register contents has produced the following result: (REG_SSI_POS) ≠ (REG_CMP1)
	1	A comparison of the register contents has produced the following result: (REG_ SSI_POS) = (REG_CMP1)
REG_WR_ACEPT	0	Writing the user data from the process output to the register addressed with REG_WR_ADR in the process output could not be done.
	1	Writing the user data from the process output to the register addressed with REG_WR_ADR in the process output was successful.
REG_WR_AKN	0	No modification of the data in the register bank by process output, i.e. REG_WR = 0. A write job would be accepted with the next telegram of process output data. (handshake for data transmission to the register.)
	1	A modification of the register contents by a process output was initiated, i.e. REG_WR = 1 → chapter "Process output (PZDA)". A write job would not be accepted with the next telegram of process output data.

Table 12-1: Meaning of the data bits (process input)

Designation	Value	Description
SSI_STS3	0	These four bits transfer the status bits of the SSI encoder with the status messages of the SSI module. With some SSI encoders, the status bits are transferred together with the position value.
	1	
SSI_STS2	0	
	1	
SSI_STS1	0	
	1	
SSI_STS0	0	
	1	
REG_RD_ABORT	0	The reading of the register defined in REG_RD_ADR has been accepted and executed. The content of the register can be found in the user data (REG_RD_DATA, byte 0-3).
	1	Reading of the register defined in REG_RD_ADR has not been accepted. The user data range (REG_RD_DATA Bytes 0-3) is zero.
REG_RD_ADR	0…63	Address of the register to be read. If the read operation is successful (REG_RD_ABORT = 0), the user data is located in REG_RD_DATA of the process input data (bytes 0 to 3).
REG_RD_DATA	0 bis 2^{32}-1	Content of the register to be read if REG_RD_ABORT=0. If REG_RD_ABORT =1, then REG_RD_DATA=0.

Process output data (PZDA)

Field output data is output from an BL67-1SSI-module to a field device.

The process output data is the data that is transferred by the PLC via a gateway to the BL67-1SSI-module.

The transmission is realized in a 8-byte format which is structured as follows:

- 4 bytes are used for representing the data that is to be written to the register with the address specified at REG_WR_DATA.
- 1 byte contains the register address for the data that is to be read with the next response telegram.
- 1 byte contains the register address of the data to be written to bytes 0 to 3 of this telegram and a write request.
- 1 byte is used for controlling the comparison operations.
- 1 byte contains a Stop bit for interrupting communication with the encoder.

Byte	Byte DP/PN	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
		Control data							
n	n + 7	STOP	-	-	-	-	-	-	-
n + 1	n + 6	-	-	-	CLR CMP2	EN CMP2	-	CLR CMP1	EN CMP1
n + 2	n + 5	REG_WR	-	REG_WR_ADR					
n + 3	n + 4	-	-	REG_RD_ADR					
		Data bytes							
n + 4	n + 3	REG_WR_DATA, data byte 0							
n + 5	n + 2	REG_WR_DATA, data byte 1							
n + 6	n + 1	REG_WR_DATA, data byte 2							
n + 7	n	REG_WR_DATA, data byte 3							

n = offset of input data; depending on extension of station and the corresponding fieldbus.

Meaning of the data bits (process output)

Table 12-2: Meaning of the data bits (process output)

Designation	Value	Description
STOP	0	Request to read the SSI encoder cyclically
	1	Request to interrupt communication with the encoder
CLR_CMP2	0	Default status, i.e. no reset of FLAG_CMP2 active.
	1	Reset of FLAG_CMP2 active.
EN_CMP2	0	Default status, i.e. the data bits REL_CMP2, STS_CMP2 and FLAG_CMP2 always have the value 0, irrespective of the actual SSI encoder value.
	1	Comparison active, i.e. the data bits REL_CMP2, STS_CMP2 and FLAG_CMP2 always have a value based on the result of the comparison with the SSI encoder value.

Table 12-2: Meaning of the data bits (process output)

Designation	Value	Description
CLR_CMP1	0	Default status, i.e. reset of FLAG_CMP1 not active.
	1	Reset of FLAG_CMP1 active.
EN_CMP1	0	Default status, i.e. the data bits REL_CMP1, STS_CMP1 and FLAG_CMP1 always have the value 0, irrespective of the actual SSI encoder value.
	1	Comparison active, i.e. the data bits REL_CMP1, STS_CMP1 and FLAG_CMP1 always have a value based on the result of the comparison with the SSI encoder value.
REG_WR	0	Default status, i.e. there is no request to overwrite the content of the register with the address stated at REG_WR_ADR with REG_WR_DATA. Bit REG_WR_AKN (→ chapter process input (PZDE)") is reset (0).
	1	Request to overwrite the content of the register with address REG_WR_ADR with REG_WR_DATA.
REG_RD_ADR	0…63	Address of the register which has to be read. If the reading was successful (REG_RD_ABORT = 0), the user data can be found in REG_RD_DATA in the status interface (bytes 4-7).
REG_WR_DATA	0 bis 2^{32}-1	Value which has to be written to the register with the address REG_WR_ADR.

12.3.3 Internal registers - read and write operations

The SSI module is provided with a universal register interface that enables access to up to 64 registers.

These are accessed via the process data. For write access, it must be ensured beforehand that the register write interface is in the default status and that a write access operation is therefore not currently active. This is ensured if REG_WR = 0 in the process output data, and is confirmed in the process input data with REG_WR_AKN = 0. Write access is then possible. The following values must be transferred with the process output data for this:

- REG_WR_ADR = register address,
- REG_WR_DATA = value to be written (32 bit)
- REG_WR = 1 (write command)

The SSI module acknowledges the processing of the write command via the process input data by signaling REG_WR_AKN = 1. REG_WR_ACCEPT = 1 in the process input data confirms whether the write operation to the register was successfully completed. If the register could not be written (no access authorization, out of value range, …), this is indicated by REG_WR_ACCEPT = 0. The write operation must then be terminated by REG_WR = 0 in order to resume the default state.

The address specified at REG_RD_ADR of the process output data is used for read access. The read register content is entered in REG_RD_DATA (bytes 4-7) if the address at REG_RD_ADR was accepted in the process input data and if REG_RD_ABORT = 0 confirms that the register was read error-free. REG_RD_ABORT = 1 indicates that the register could not be read. REG_RD_ADR in the process input data then contains the address that could not be accessed successfully. The user data is then set to ZERO.

12.3.4 Register access and meaning

Table 12-3: Register description

Designation	No.	Description	Default (HEX)
REG_SSI_POS	0	Actual binary SSI encoder value	
REG_MAGIC_NO	1	Magic number (0xaa55cc33)	
REG_HW_VER	2	Hardware version	
REG_SW_VER	3	Software version	
REG_SF	4	Special Function register	
	5 to 13	reserved	
REG_WR_ADR	14	Pointer register OUT	
REG_RD_ADR	15	Pointer register IN	
REG_DIAG1	16	Diagnostics	
	17 to 19	reserved	
REG_PARA1	20	parameter data	0×1901 0000
	21 to 31	reserved	
REG_GRAY_POS	32	Actual Gray-coded SSI encoder value.	

REG_SSI_FRAME	33	Complete frame read from SSI encoder.	
REG_CMP1	34	Reference value 1	0×0000 0000
REG_CMP2	35	Reference value 2	0×0000 0000
REG	36 to 47	reserved	
REG_LOWER_LIMIT	48	Lower limit	0×0000 0000
REG_UPPER_LIMIT	49	upper limit	0×FFFF FFFF
REG_OFFSET	50	Offset value	0×0000 0000
REG_SSI_MASK	51	Selection of the SSI encoder diagnostics transferred to the diagnostics interfaces.	0×0000 0000
REG	52 to 63	reserved	

Table 12-4: Designation of the interfaces

Designation		**Interfaces**				
		Process output	Storage in module	Process input	Param.	Diagn.
REG_SSI_POS	0			RD		
REG_MAGIC_NO	1			RD		
REG_HW_VER	2			RD		
REG_SW_VER	3			RD		
REG_SF	4	WR	volatile	RD		
REG_WR_ADR	14			RD		
REG_RD_ADR	15			RD		
REG_DIAG1	16			RD		RD
REG_PARA1	20	WR	non volatile	RD	WR	
REG_GRAY_POS	32			RD		
REG_SSI_FRAME	33			RD		
REG_CMP1	34	WR	volatile	RD		
REG_CMP2	35	WR	volatile	RD		
REG_LOWER_LIMIT	48	WR	non volatile	RD		
REG_UPPER_LIMIT	49	WR	non volatile	RD		
REG_OFFSET	50	WR	non volatile	RD		

	REG_SSI_MASK	51	WR	non volatile	RD		

NOTE

The non volatile registers can be written maximum 100.000 times.

^

12.3.5 Comparison value 1, comparison value 2

The recorded encoder position can be compared with two loadable values. The character "x" below stands for "1" or "2". The register contents are loaded into the register REG_CMPx using in a write operation. The comparison functions are activated by setting bit EN_CMPx = 1 in the process output data. The results of the continuous comparison operations are displayed in the process input data via STS_CMPx, REL_CMPx and FLAG_CMPx. Bit REL_CMPx indicates as the actual status message the relation of the actual value (register content of REG_SSI_POS) to the comparison value (register content of REG_CMPx). Bit STS_CMPx is non-retentive and indicates whether the current actual value (REG_SSI_POS) and the comparison value (REG_CMPx) match. FLAG_CMPx is also used as a marker to indicate that the status (REG_SSI_POS = REG_CMPx) is present or has been passed. This bit must be reset by the application via the process output data using CLR_CMPx = 1. If the comparator is inactive (EN_CMPx = 0), the signals from STS_CMPx, REL_CMPx and FLAG_CMPx are always zero.

Table 12-5: Comparator enable

Process input data		**Process output data**
	REL_CMPx = 0 STS_CMPx = 0 FLAG_CMPx = 0	

A

The value Z0 o this flag is 1 as soon as the comparison values match. The value stays 1 until it is reset.

Process input data		**Process output data**
(REG_SSI_POS) < (REG_CMPx)		
	REL_CMPx = 1 STS_CMPx =0 FLAG_CMPx = Z0 **A**	Reset of FLAG_CMPx with CLR_CMPx = 1
(REG_SSI_POS) > (REG_CMPx)		
	REL_CMPx = 1 STS_CMPx =0 FLAG_CMPx = Z0 **A**	Reset of FLAG_CMPx with CLR_CMPx = 1
(REG_SSI_POS) = (REG_CMPx)		
	REL_CMPx = 1 STS_CMPx = 1 FLAG_CMPx = 1	Rest of FLAG_CMPx not possible, as long as equality exists.

12.3.6 Lower limit, upper limit

The recorded encoder position can be compared with two loadable values. The upper limit value must be entered in the REG_UPPER_LIMIT register and the lower limit value in REG_LOWER_LIMIT. Writing these registers with values that are different to the default values will activate the monitoring of the limits, and bits STS_OFLW and STS_UFLW will be enabled in the process input data. The diagnostics function will indicate the presence of values above or below the default values.

"Encoder value overflow" and "Encoder value underflow" signals will also indicate this via the acyclic diagnostics interface.

The limit values are set by default to the maximum and minimum value.

Table 12-6: Overflow of the encoder values

Register access	Process input data	Diagnostic message
REG_UPPER_LIMIT at default value FFFFFFFFh	STS_OFLW = 0	Value: 0
Register content of REG_UPPER_LIMIT less than FFFFFFFFh	(REG_SSI_POS) ≤ (REG_UPPER_LIMIT) STS_OFLW = 0	Value: 0
	(REG_SSI_POS) > (REG_UPPER_LIMIT) STS_OFLW = 1	Value: 1 Text: overflow

Table 12-7: Overflow of the encoder values

Register access	Process input data	Diagnostic message
REG_LOWER_LIMIT at default value FFFFFFFFh	STS_UFLW = 0	Value: 0
Register content of REG_LOWER_LIMIT larger than 0	(REG_SSI_POS) ≥ (REG_LOWER_LIMIT) STS_UFLW = 0	Value: 0
	(REG_SSI_POS) < (REG_LOWER_LIMIT) STS_UFLW = 1	Value: 1 Text: undervoltage

12.3.7 Offset function/load value

This function is activated by writing the REG_OFFSET register with a value <> 0. The content of the register is then subtracted from the SSI encoder value and stored in REG_SSI_POS. All limit values, such as lower limit, upper limit, comparison value 1, comparison value 2 then refer to the newly calculated value (REG_SSI_POS).

The calculation is thus:

(REG_SSI_POS) = SSI encoder - (REG_OFFSET)´

This function can be deactivated by writing the REG_OFFSET with zero.

12.3.8 Status messages of the SSI encoder

Some SSI encoders not only transfer the position value in the data frame that they transfer to the module but also supply additional status messages. It is useful to include these status messages in the application in order to analyze the measured value.

Writing the REG_SSI_MASK register allows up to four individual bits to be taken from the data frame of the SSI encoder and transferred to the SSI_STSx bits of the process input data.
It is also possible to output the "SSI encoder group diagnostics message" with an acyclic diagnostics operation when a status message is initiated.

Table 12-8: Masking with REG_SSI_ MASK

Process input data	**REG_SSI_MASK**							
	Byte	**Bit 7**	**Bit 6**	**B 5**	**B 4**	**B 3**	**B 2**	**B 1**
SSI_STS0	0	EN_ D0_RMS0	EN_D0_DS	X	SSI_FRAME_BIT_SEL0			
SSI_STS1	1	EN_ D1_RMS1	EN_D1_DS	X	SSI_FRAME_BIT_SEL1			
SSI_STS2	2	EN_ D2_RMS2	EN_D2_DS	X	SSI_FRAME_BIT_SEL2			
SSI_STS3	3	EN_ D3_RMS3	EN_D3_DS	X	SSI_FRAME_BIT_SEL3			

Table 12-9: Description of diagnostic data

A *Default*

Designation	**Value**	**Description**
EN_Dx_RMSx	0 **A**	The transfer of the SSI status messages to the process input data is not activated
	1	The transfer of the SSI status messages to the process input data is activated
EN_ Dx_DS	0**A**	The evaluation of the SSI status messages for bit 0 of the diagnostics is not activated
	1	The evaluation of the SSI status messages for bit 0 of the diagnostics is activated.
SSI_FRAME_BIT_SEL	0-31	Definition of the selected bits in the frame of the SSI encoder to be evaluated or copied. default 0

The following applies to bit 0 (SSI group diagnostics) of the diagnostics interface and SSI_DIAG of the process input data:

(SSI_STS0 & EN_D0_DS) || (SSI_STS1 & EN_D1_DS) || (SSI_STS2 & EN_D2_DS) || (SSI_STS3 & EN_D3_DS)

12.3.9 Resetting the register bank

If register REG_SF is written with the signature:

"Id20" = 0 x 6C643230

all default values of the retentive registers including the parameter registers are reset.

If register REG_SF is written with the signature:

"Id48" = 0 x 6C643438

all default values of the retentive registers except the parameter registers are reset.

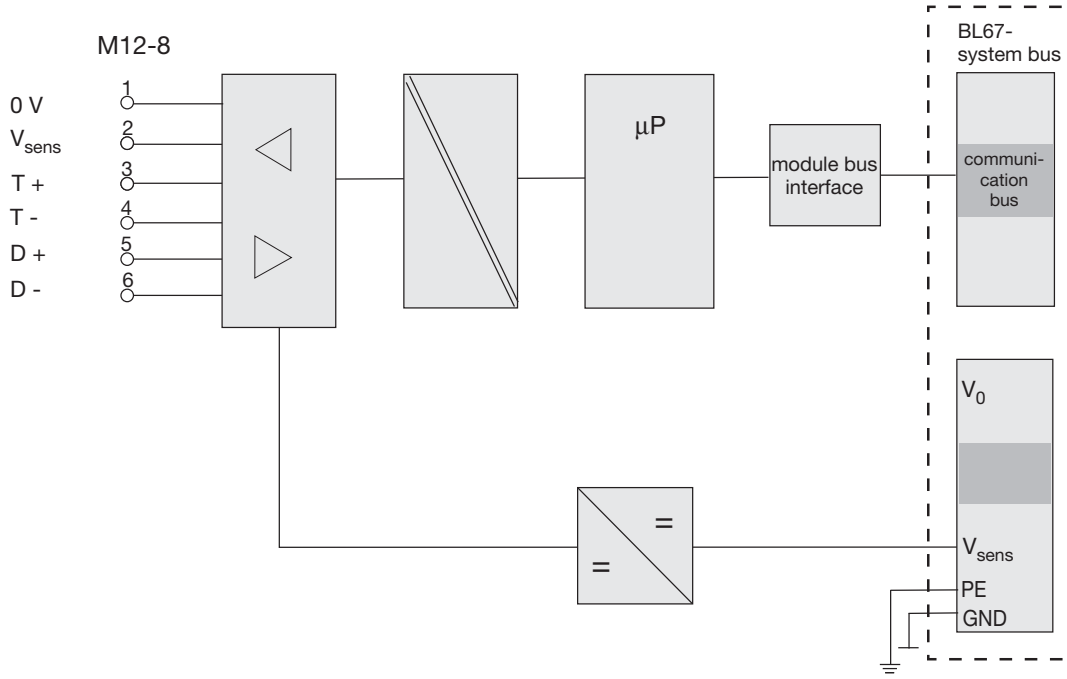
NOTE

Overwritten values are lost.all default values of the retentive registers (incl. parameter registers) are reset.

12.3.10 Technical data

Figure 12-21: Electronic module BL67-1SSI

Figure 12-22: Block diagram BL67-1SSI



The module is provided with two RS422 interfaces that form one SSI interface. One RS422 interface works as the clock generator for reading the data, which is then received on the other RS422 interface.

Table 12-10: Technical data BL67-1SSI

Designation	BL67-1SSI
Number of SSI-interfaces	1
Encoder voltage	24 VDC (-15%/+20%)
Encoder current	max. 500 mA (non short-circuit proof)
Clock output type	RS422
Signal input type	RS422
RS422 cable length	max. 30 m
Nominal voltage from supply terminal	24 VDC
Nominal current from supply terminal (field) I_L	25 mA (without encoder current)
Nominal current consumption from 5 VDC (module bus) I_{MB}	< 50 mA
Power loss of the module	< 1 W
Isolation voltage	
U_{TMB} (module bus/field)	max. 1000 VDC
U_{FE} (field/functional earth)	max. 1000 VDC
U_{field} (field voltage/IO-connectors)	0 V

12.3.11 Diagnostic and status messages

LED status messages

Table 12-11: LED status messages

LED	Display	Meaning	Remedy
D	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway. Additionally check, if the SSI.encoder is correctly working and supports the data cable test in the required form.
	off	No error messages or diagnostics	–
UP	Green	Direction of movement up	–
	off	No direction of movement up	–
DN	Green	Direction of movement down	–
	off	No direction of movement down	–

Diagnostics

This module has the following diagnostic data per channel:

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
-	-	-	Configuration error	Underflow	Overflow	Wire break	SSI group diagnostics

Table 13: Diagnostic messages

Diagnostic message	
SSI group diagnostics	Status messages of the SSI encoder present.
Wire break	SSI encoder signal faulty (e.g. due to a cable break).
Hardware error	The module has to be replaced (e.g. error in EEPROM or UART)
overflow	SSI encoder value above upper limit. Overflow occurred.
undervoltage	SSI encoder value below lower limit. Underflow occurred.
Configuration error	The parameter settings can not be supported.

12.3.12 Module parameters

Standard				PROFIBUS PROFINET		Parameter
byte-oriented		word-oriented				
Byte 0	Bit 0	Word 0	Bit 0	Byte 3	Bit 0	reserved
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	
	Bit 5		Bit 5		Bit 5	Sensor idle data signal test
	Bit 6		Bit 6		Bit 6	reserved
	Bit 7		Bit 7		Bit 7	
Byte 1	Bit 0		Bit 8	Byte 2	Bit 0	Invalid bits (LSB)
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	Invalid bits (MSB)
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	reserved
Byte 2	Bit 0	Word 1	Bit 0	Byte 1	Bit 0	Transmission rate
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	reserved
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 3	Bit 0		Bit 8	Byte 0	Bit 0	Data frame bits
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	reserved
	Bit 7		Bit 15		Bit 7	Data format

:

Table 14: Module parameters

A *Default setting*

Parameter name	Value	
Sensor idle data test	yes **A**	ZERO test of data cable.
	no	After the last valid bit, a ZERO test of the data cable is not carried out.

Table 14: Module parameters

A *Default setting*

Parameter name	Value	
Invalid bits (LSB)	"0" to "15"	Number of invalid bits on the LSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: SSI_FRAME_LEN - INVALID_BITS_MSB- INVALID_BITS_LSB. The invalid bits on the LSB side are removed by shifting the position value to the right, starting with the LSB. (Default 0 bit = 0×0). INVALID_BITS_MSB +INVALID_BITS_LSB must always be less than SSI_FRAME_LEN.
Invalid bits (MSB)	"0" to "7"	Number of invalid bits on the MSB side of the position value supplied by the SSI encoder. The meaningful word width of the position value transferred to the module bus master is as follows: SSI_FRAME_LEN - INVALID_BITS_MSB - INVALID_BITS_LSB. Number of invalid bits on the MSB side of the position value supplied by the SSI encoder. INVALID_BITS_MSB +INVALID_BITS_LSB must always be less than SSI_FRAME_LEN. Default: $0 = 0_{hex}$
transmission rate	1000000 bps 500000 bps **A** 250000 bps 125000 bps 100000 bps 83000 bps 71000 bps 62500 bps	
Number of data frame bits	1 to 32	Number of bits of the SSI data frame. SSI_FRAME_LEN must always be greater than INVALID_BITS. Default: $25 = 19_{hex}$
Data format	binary coded **A**	SSI encoder sends data in binary code
	GRAY coded	SSI encoder sends data in GRAY code

12.3.13 Base modules/pin assignment

- BL67-B-1M12-8

Figure 12-23: BL67-B-1M12-8

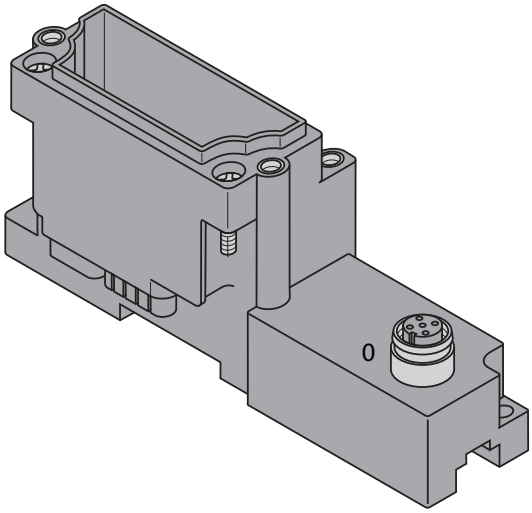
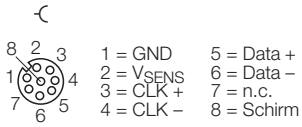


Figure 12-24: Pin assignment BL67-1SSI with BL67-B-1M12-8



- BL67-B-1M23/BL67-B-1M23-VI

Figure 12-25: BL67-B-1M23/ BL67-B-1M23-VI

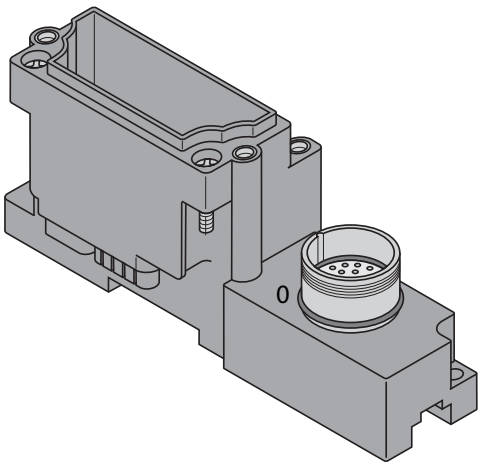


Figure 12-26: Pin assignment BL67-1SSI with BL67-B-1M23

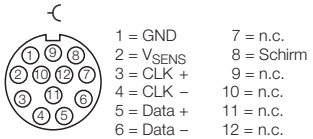


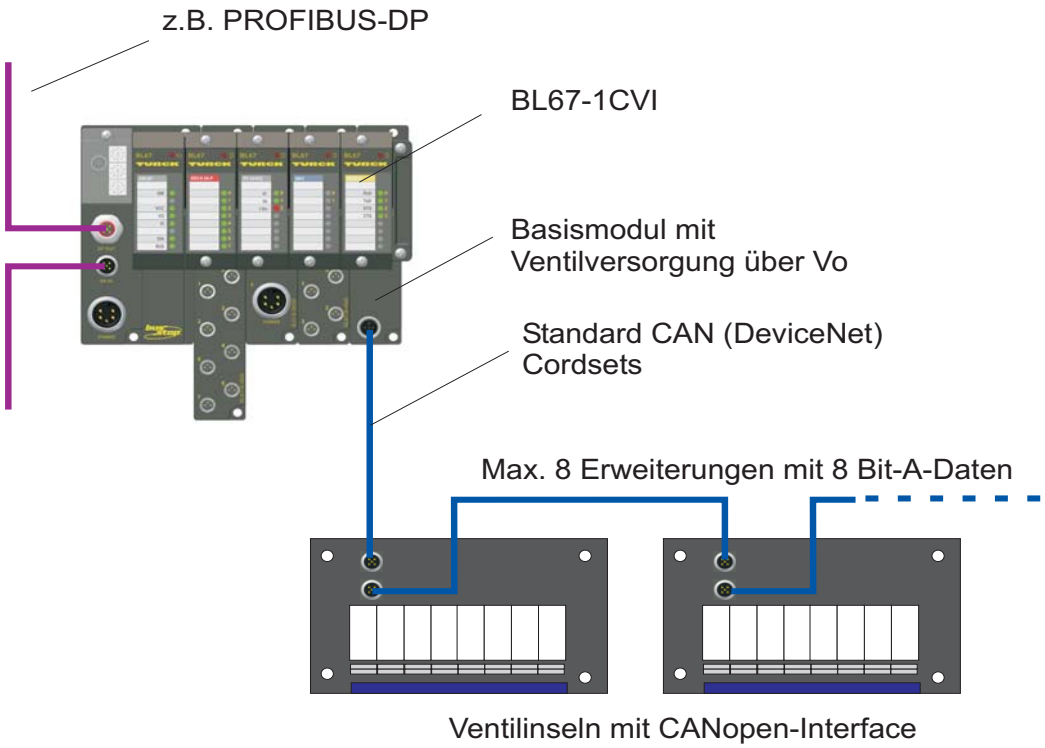
Figure 12-27: Pin assignment BL67-1SSI with BL67-B-1M23-VI

1 = GND
2 = V_{SENS}
3 = CLK +
4 = CLK –
5 = Data +
6 = Data –
7 = n.c.
8 = Schirm
9 = V_{SENS}
10 = V_{SENS}
11 = V_{SENS}
12 = GND

12.4 BL67-1CVI

The module BL67-1CVI is an interface to the CAN bus. It serves to connect simple digital CANopen device (e.g. valve terminals of different manufacturers) to a BL67-System.

Figure 12-28: Example for connecting valve terminals to BL67-1CVI



12.4.1 Technical data

Figure 12-29: Electronic module BL67-1CVI

Figure 12-30: Block diagram BL67-1CVI

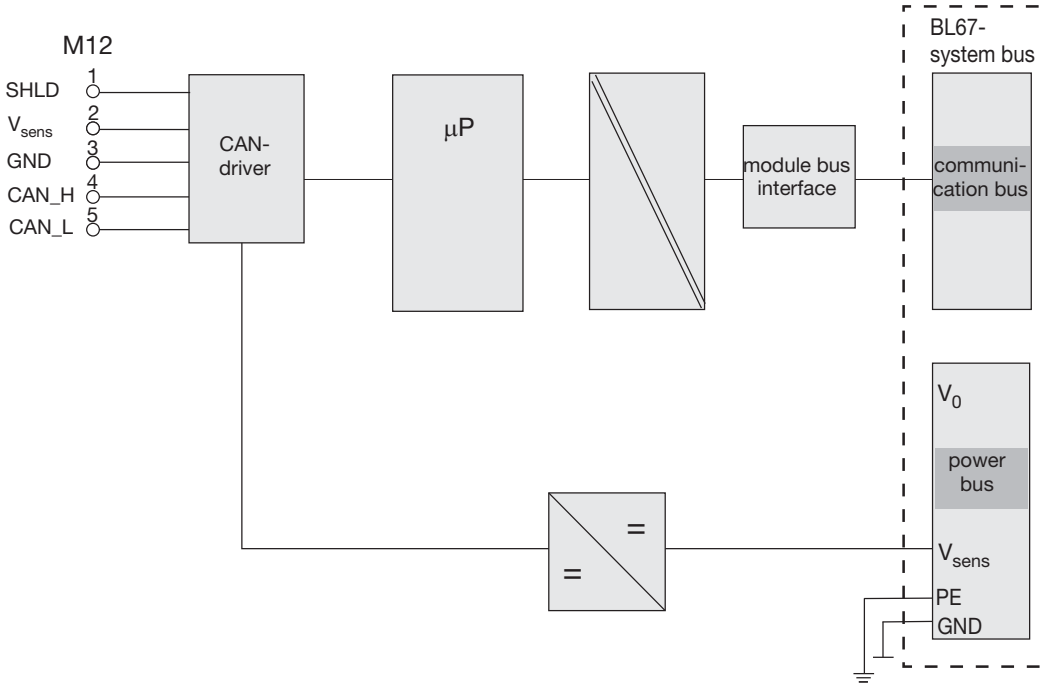


Table 12-1: Technical data

Designation	BL67-1CVI
Number of channels	1
Nominal voltage from supply terminal	24 VDC
Load voltage V_O	24 VDC
Voltage range	18 to 30 VDC
Nominal current consumption from 5 VDC (module bus) I_{MB}	≤ 30 mA
Nominal current from supply terminal (field) I_L	< 100 mA (if load current = 0)
Power loss of the module, typical	< 1.5 W
CAN	
U_{RS1} (active)	min. 500 mV
U_{RS1} (inactive)	max. 200 mV
U_{GLRS} (common mode)	-7 to 12 V
Power supply (valve electronic)	
Output current	
High level $_A$ (nominal value)	0.5 A
High-level I_{AMAX}	0.6 A (according to IEC 6 1131-2)
Switch-on resistance R_{ON}	190 mΩ
Simultaneity factor	100 %
Switch-off characteristic K_A	
I_{OUT} > 1.5 A	< 4 ms
1.0 A < I_{OUT} ≤ 1.5 A	< 10 s
0.6 A < I_{OUT} ≤ 1.0 A	min. 10 s/max. 60 s
Power supply (valves)	
Output current	
High level $_A$ (nominal value)	1 A
High-level I_{AMAX}	1.2 A (according to IEC 6 1131-2)
Switch-on resistance R_{ON}	95 mΩ
Simultaneity factor	100 %
Switch-off characteristic K_A	
I_{OUT} > 3 A	< 4 ms
2 A < I_{OUT} ≤ 3 A	< 10 s
1.2 A < I_{OUT} ≤ 2 A	min. 10 s/max. 60 s

Isolation voltages	
U_{TMB} (module bus/field, CAN)	max. 1000 VDC
U_{field}(field/CAN)	0 VDC
U_{field} (supply valve electronic/CAN)	0 VDC
U_{field}(supply valves/CAN)	0 VDC
Short-circuit proof	yes, according to EN 61131-2

12.4.2 Process data

The process data of the CVI-module mirror the data of the connected CANopen-nodes depending on their parameterization (see Table 12-6: Configuration possibilities for the CANopen-nodes). The process data begin with the data of the node with the lowest address, followed by the data of all other modules in chronological order. This applies to both, in- and output data.

NOTE

The input data of not connected or disturbed CANopen-nodes are assumed as "0".

12.4.3 Diagnostic and status messages

LED status messages

Table 12-2: LED status messages

A *Additionally, check the voltage V_i at the gateway (see note).*

LED	Display	Meaning	Remedy
D	Red, flashing, 0.5 Hz	Diagnostics pending Diagnostics	-
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. This concerns modules located between this module and the gateway.
	off	No error messages or diagnostics	-
BUS	Orange (+ **Error** = red)	Not all configured CANopen-nodes are online and in Operational mode.	Please check the connected CANopen-nodes.
	Green	All configured CANopen-nodes are online and in Operational mode.	
Error	Red	Communication between interface and other bus nodes disturbed: - CAN BusOff - Heartbeat- error - Guarding- error - Transmit-Timeout	Control the CAN-communication between the nodes
Error	off	Communication between CVI and other bus nodes OK	
VE	Green	Valve electronic power supply is switched on.**A**	
	Red	Over load/short-circuit in valve electronic power supply	Eliminate the cause for the short-circuit or the overload.
VC	Green	Valve power supply is switched on.	
	Red	Over load/short-circuit in valve power supply	Eliminate the cause for the short-circuit or the overload.

NOTE

The green LEDs "VE" and "VC" do not show the existence of the voltages. They only display that there is no over current switch-off.

Diagnostics

This module has the following diagnostic data per channel:

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Diagnostic data of the CANopen-nodes							
n	DiagNode 2				DiagNode 1			
…								
n + 3	DiagNode 8				DiagNode 7			
n + 4	DiagCVI							
n + 5	reserved							
n + 6	TX_data byte 4							

Table 12-3: Diagnostics

Name	Description
DiagNode x	Diagnostics of the respective node. (see Table 12-4: Diagnostic data of the CANopen node)
DiagCVI	Global diagnostics CVI module (see Table 12-5: Global diagnostics of the CVI module)

Table 12-4: Diagnostic data of the CANopen node

Bit	Name	Description
0	Emergencies transmitted since module start.	The emergency messages may already be eliminated. The diagnosis is deleted 10 s after eliminating **all** communication and application errors of **all** nodes.
1	Node transmitted emergencies	
2	Communication error transmitted since module start/Guard Time	The communication errors may already be eliminated. The diagnosis is deleted 10 s after eliminating **all** communication and application errors of **all** nodes.
3	Communication error/Guard Time timeout	

Table 12-5: Global diagnostics of the CVI module

Bit	Name	Description
0	Emergencies transmitted since module start.	
1	Node address not within permissible range (1-8)	This error is only deleted after a module-restart.
2	Overcurrent VC (valve power supply)	
3	Overcurrent VE (valve electronic power supply)	

12.4.4 Module parameters

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
CAN node 1	Byte 0	Bit 0	Word 0	Bit 0	Byte 0	Bit 0	Activate node
		Bit 1		Bit 1		Bit 1	Activate guarding
		Bit 2		Bit 2		Bit 2	Input data size
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	Output data size
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
CAN node 2	Byte 1	Bit 0		Bit 8	Byte 1	Bit 0	Activate node
		Bit 1		Bit 9		Bit 1	Activate guarding
		Bit 2		Bit 10		Bit 2	Input data size
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	Output data size
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
CAN node 3	Byte 2	Bit 0	Word 1	Bit 0	Byte 1	Bit 0	Activate node
		Bit 1		Bit 1		Bit 1	Activate guarding
		Bit 2		Bit 2		Bit 2	Input data size
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	Output data size
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
CAN node 4	Byte 3	Bit 0		Bit 8	Byte 3	Bit 0	Activate node
		Bit 1		Bit 9		Bit 1	Activate guarding
		Bit 2		Bit 10		Bit 2	Input data size
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	Output data size
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
CAN node 5	Byte 4	Bit 0	Word 2	Bit 0	Byte 4	Bit 0	Activate node
		Bit 1		Bit 1		Bit 1	Activate guarding
		Bit 2		Bit 2		Bit 2	Input data size
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	Output data size
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
CAN node 6	Byte 5	Bit 0		Bit 8	Byte 5	Bit 0	Activate node
		Bit 1		Bit 9		Bit 1	Activate guarding
		Bit 2		Bit 10		Bit 2	Input data size
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	Output data size
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

	Standard				PROFIBUS PROFINET		Parameter
	byte-oriented		word-oriented				
CAN node 7	Byte 6	Bit 0	Word 3	Bit 0	Byte 6	Bit 0	Activate node
		Bit 1		Bit 1		Bit 1	Activate guarding
		Bit 2		Bit 2		Bit 2	Input data size
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	Output data size
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
CAN node 8	Byte 7	Bit 0		Bit 8	Byte 7	Bit 0	Activate node
		Bit 1		Bit 9		Bit 1	Activate guarding
		Bit 2		Bit 10		Bit 2	Input data size
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	Output data size
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
CVI module	Byte 8	Bit 0	Word 4	Bit 0	Byte 8	Bit 0	Guarding time [n*0.1s]
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	
		Bit 4		Bit 4		Bit 4	
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 9	Bit 0		Bit 8	Byte 9	Bit 0	Life Time Factor
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	
	Byte 10	Bit 0	Word 5	Bit 0	Byte 10	Bit 0	transmission rate
		Bit 1		Bit 1		Bit 1	
		Bit 2		Bit 2		Bit 2	
		Bit 3		Bit 3		Bit 3	Activate terminating resistor
		Bit 4		Bit 4		Bit 4	reserved
		Bit 5		Bit 5		Bit 5	
		Bit 6		Bit 6		Bit 6	
		Bit 7		Bit 7		Bit 7	
	Byte 11	Bit 0		Bit 8	Byte 11	Bit 0	reserved
		Bit 1		Bit 9		Bit 1	
		Bit 2		Bit 10		Bit 2	
		Bit 3		Bit 11		Bit 3	
		Bit 4		Bit 12		Bit 4	
		Bit 5		Bit 13		Bit 5	
		Bit 6		Bit 14		Bit 6	
		Bit 7		Bit 15		Bit 7	

Table 12-6: Configuration possibilities for the CANopen-nodes

Parameter name	Description
Configuration of the CANopen-nodes	
Activate node	0 =no **A** 1 = yes
Activate guarding	0 =no **A** 1 = yes
Input data size	Length of the node's input data. 000 = 0 bit **A** 001 = 4 bit 010 = 8 bit 011 = 12 bit 100 = 16 bit 101 = 24 bit 110 = 32 bit 111 = reserved
Output data size	Length of the node's output data. 000 = 0 bit **A** 001 = 4 bit 010 = 8 bit 011 = 12 bit 100 = 16 bit 101 = 24 bit 110 = 32 bit 111 = reserved
Configuration CVI module	
Guarding time [n*0.1s]	Setting the Guard-Time in steps of 100 ms (value 0 to 255); default 3 = 300 ms
Life Time Factor	Factor which defines how often a node is allowed not to answer a request or to exceed the Guard-Time (values 0 to 255); default = 3
Configuration of CANopen	
Transmission rate	Baud rate CANopen 000 = 1000k 001 = reserved 010 = 500k 011 = 250k 100 = 125k **A** 101 = 50k 110 = 20k 111 = 10k
Activate terminating resistor	Activation of the terminating resistor. 0 = no terminating resistor **A** 1 = terminating resistor active

12.4.5 Base modules/pin assignment

- BL67-B-1M12

Figure 12-31: BL67-B-1M12

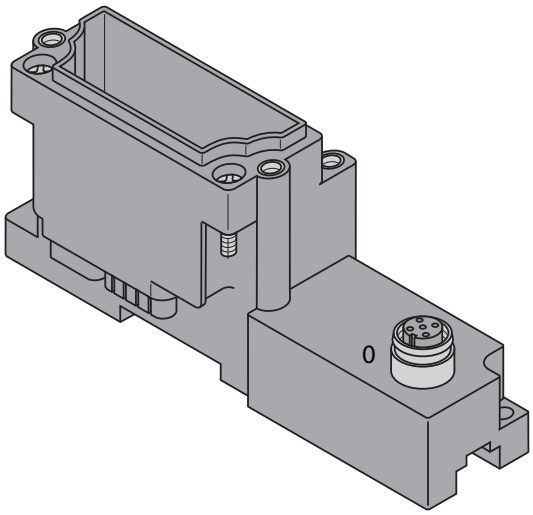
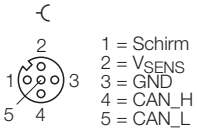


Figure 12-32: Pin assignment BL67-1CVI with BL67-B-1M12



1 = Schirm
2 = V_{SENS}
3 = GND
4 = CAN_H
5 = CAN_L

12.4.6 Important notes for using the CVI module

In order to guarantee a trouble-free communication between the valve interface and the connected CANopen nodes, please follow these notes during the start-up of BL67-1CVI:

1. When connecting the CANopen nodes to the CVI module, all regulations concerning the installation of a CANopen network have to be considered, above all, the rules for terminating a CANopen network.
   If the CVI module is the first or the last node in the network, the terminating resistor has to be activated via a module parameter.
2. The BL67-system as well as the CANopen nodes have to be supplied meeting the demands for voltage supply.
3. Please set the CANopen station addresses at the nodes. The first node in the CANopen subnet receives address "1".
4. Please set identical baud rates at the CVI module and each CANopen node. With different baud rate-setting, the CVI module and the connected CANopen nodes can not communicate.
5. Please parameterize the connected CANopen nodes according to the application. Activate present nodes and deactivate inactive nodes, activate/deactivate the guarding and set the length of in- and output data for every active node.
6. If the LEDs of the CVI module and the CANopen nodes switch to green, the system runs without problems.

12.5 BL67-1CNT/ENC

The BL67-1CNT/ENC allows the connection of encoders as well as signal- and direction inputs, whereas the output of the direction is optional.

The module provides a 24 VDC power supply of connected encoders.

The counter can be used as input module for RS422-outputs as well as digital input with a parameterizable threshold for push-pull-outputs (single ended) (0 to 30 V) (see parameter Encoder signal).

- RS422-input:
  - signal evaluation between A, B, Z and /A, /B, /Z
  - power supply of 5 V-encoders has to be realized externally
- push-pull-input (single ended)
  (digital input with parameterizable threshold):
  - signal evaluation between A, B, Z and GND.
    The inputs /A, /B and /Z are internally connected to GND.
  - push-pull-inputs (0 to 30 V)
  - threshold freely parameterization (1 to 18 VDC)

Additionally, the module provides 4 digital outputs and 4 digital inputs, whereas the channels DI0 and DO0 and DI1 and DO1 respectively are connected to the same contact (DIO0 and DIO1).

The digital inputs can be used as counter release.

Operation modes

Count mode

- Rotary sensor
- Pulse and direction

Measurement mode

- Frequency measurement/revolution measurement
- Period duration measurement

12.5.1 Getting started

The following section shows the general procedure for reading the count value:

1 Short parameterization (if necessary):

- If no external encoder power supply is used, the supply can be realized using output DO3 of the module.
  To realize this, the parameter "function DO3" (byte 1, bit 2) has to be set to "1 = Encoder power supply" (see Module parameters, page 12-85).
- If no external encoder power supply is used, the input DI3 of the module can be used as encoder-GND.
  To realize this, the parameter "function DI3" (byte 1, bit 1) has to be set to "1 = Encoder GND" (see Parameters of the counter module, Module parameters, page 12-85).

2 Counter release:

- The count process is released by setting the process output bit "GATE" from 0 → 1 (see Process output/control interface Byte 0, Bit 1, page 12-81).
  → The counter is activated and the count process starts.

3 Read out the counter value

- The counter value can be read out from bytes 4 to 7 "REG_RD_DATA" of the Process input/status interface (see page 12-81).

NOTE

For further information about the functions of BL67-1CNT/ENC (parameterization, process image, internal registers etc.), please read the following pages.

12.5.2 Count mode

After the release signal, the counter module counts from the load value continuously between the upper and lower limit.

The release is activated by the rising edge from 0 → 1 of the control bit Gate in the Process output/control interface.

- If the counter counts up and reaches the upper count limit, it will jump to the lower count limit when another counter signal is received, and will continue to count without signal loss from this point.
- If the counter counts down and reaches the lower count limit, it will jump to the upper count limit when another counter signal is received, and will continue to count without signal loss from this point.

Limit values of count mode

The limit values have to be defined via the registers no. 36 REG_LOWER_LIMIT and no. 40 REG_UPPER_LIMIT in the Register bank of the module (page 12-92).

Maximum count ranges:

- The upper count limit is +2 147 483 647 (2^{31}-1) = 0×7FFFFFFF
- The lower count limit is -2 147 483 648 (-2^{31}) = 0×80000000

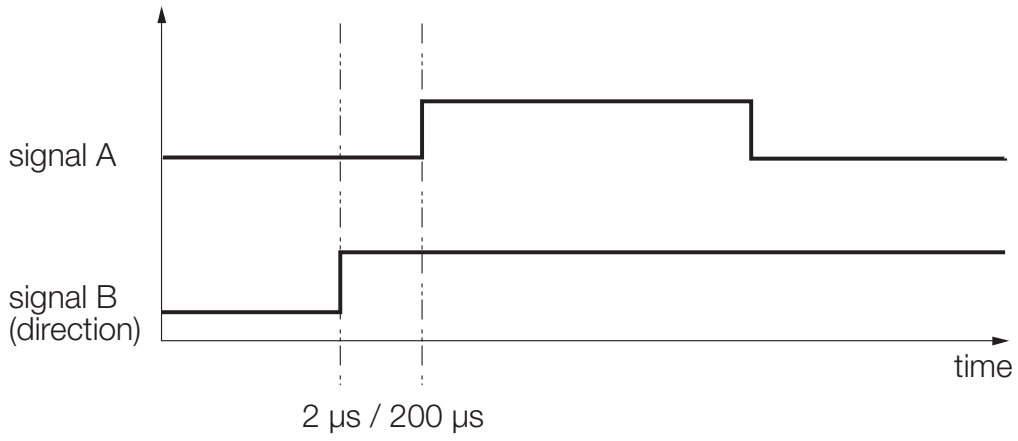
Signal evaluation A, B, Z

- Pulse and direction, single
- Pulse and direction, double
- Encoder, single
- Encoder, double
- Encoder, quadruple

Time between direction signal (B) and counter signal (A)

On pulse generators with a direction signal, it must be ensured that there is a gap of at least 2 µs/200 µs between the direction signal (B) and the counter signal (A), depending on the input filter configured.

Figure 12-33: Time between direction signal and counter signal



12.5.3 Measurement mode

General

The measurement operation has not to be started. It is done automatically, at the same time as the counting operation. Depending on the parameterization (parameter byte 3, bit 5, Measurement mode), either a frequency or a period duration count is executed.

Exception:
If, for the synchronization of the module, the parameter Synchronization with Z is set to *periodical*, then the parameter Measurement mode **has to be** set to frequency measurement in order to activate frequency measurement.

The measuring operation is started by setting the internal software release signal, or by setting the hardware **and** software release signal if the digital input is configured as a hardware release.

Frequency measurement

Definition

In this operating mode the module counts the pulses received within a specified integration time.

The integration time can be set by using the register communication via register no. 60 REG_MEASURE_TIME. It can be set in steps of 10 ms to between 10 ms and $(2^{32} -1) \times 10$ ms.

Prerequisites

- Parameter Measurement mode = 0
- Register no. 52 REG_SCALE_MUL = 1
- Register no. 56 REG_SCALE_DIV = 1
- Register no. 60 REG_MEASURE_TIME → integration time depending on the application

The value of the determined frequency is displayed as a 10^{-3} Hz value.

The measured frequency value can be read out from register no. 48 REG_MEASURED_ VALUE and, if parameterized, from the Process input/status interface (bytes 8 to 11).

NOTE

The value displayed in bytes 8 to 11 of the feedback interface (process output) is defined via parameter REG_AUX_ADR (parameter byte 14).
Here, enter the register no. of the value to be monitored (see Register bank of the module, page 12-92).

The displayed value cannot be updated until the integration time has elapsed.

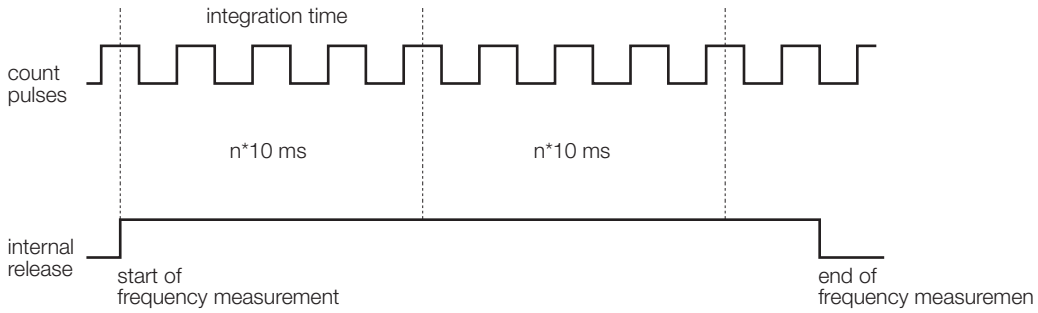


Figure 12-34: Frequency measurement with release function

Period duration measurement

Definition

In this operating mode the counter module measures the precise time between two rising edges of the counter signal in µs.

Prerequisites

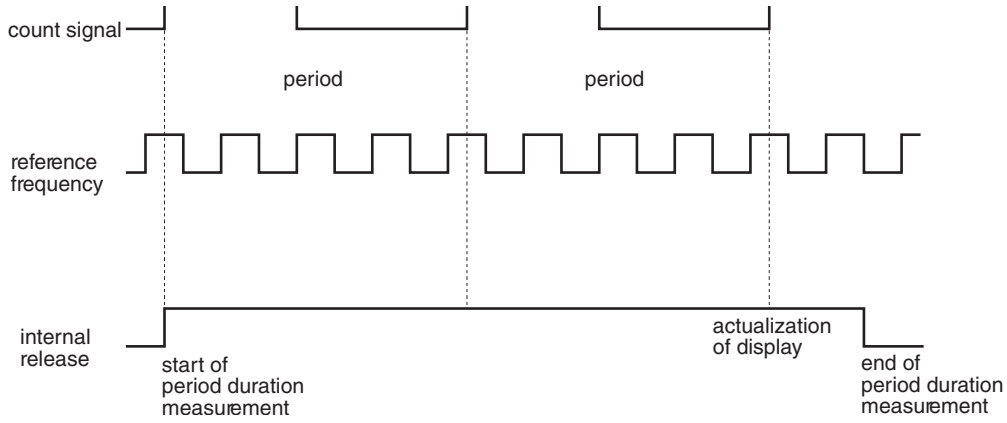
- Parameter Measurement mode = 1
- Register no. 52 REG_SCALE_MUL = 1
- Register no. 56 REG_SCALE_DIV = 1

The period duration value can be read out from register no. 48 REG_MEASURED_ VALUE and, if parameterized, from the Process input/status interface (bytes 8 to 11).

NOTE

The value displayed in bytes 8 to 11 of the feedback interface (process output) is defined via parameter REG_AUX_ADR (parameter byte 14).
Here, enter the register no. of the value to be monitored (see Register bank of the module).

Figure 12-35: Period duration measurement; no. of periods = 2



Revolutions speed measurement

The revolutions measurement is not executed directly.

In the operation mode frequency measurement (see parameter Measurement mode), the no. of revolutions (n) in 1/min can be calculated on the basis of the frequency (f).

The following applies:

- The frequency (f) is provided by the module.
- The conversion to the no. of revolutions is done **internally** by the module using the following formula in consideration of the encoder's resolution (pulses/revolution):

$$n = f \times \frac{\text{Multiplikator}}{\text{Divisor}} = f \times \frac{60}{1000 \times \text{Impulse}}$$

- The multiplier and the divisor are module registers, which have to be written according to the formula mentioned above.
  Multiplier: REG_SCALE_MUL; reg.-no. 52 (page 12-92)
  Divisor: REG_SCALE_DIV; reg.-no. 56 (page 12-92)
- Register REG_MEASURED_VALUE contains the revolutions speed.

Prerequisites

- Parameter Measurement mode = 0
- Register no. 52 REG_SCALE_MUL ≠ 1
- Register no. 56 REG_SCALE_DIV ≠ 1

Revolutions speed in higher resolution

In order to display a higher-resolved revolutions speed, e.g. 10^{-3}/min, the multiplier has to be multiplied with e.g. 10^{-3}.

$$n = f \times \frac{\text{Multiplikator} \times 1000}{\text{Divisor}}$$

12.5.4 Functions and explanations

Software gate and hardware gate

A release signal is required in order to start counting/measuring.

The counter module controls the starting and stopping of the counting/measuring operation by means of so-called "gates". A software gate and a hardware gate are provided for implementing this control both via the software (process output/control interface) and via a physical output.

- Software gate
  The release is activated by the rising edge from 0 → 1 of the control bit Gate in the Process output/control interface.
  Resetting this control bit 1 → 0 stops the measurement.
  It is always necessary to release the counter via the software-gate. If not, the operation will not be started.
  If the release is to be initiated only via the software-gate, the parameter Gate function has to be set in parameter byte 3, bits 0 to 2 (see Module parameters, page 12-85).
  Additionally, the counter release can be controlled via a hardware-gate (see below).
- Hardware gate
  The release is initiated via a high-signal (depends on the set threshold) at input Z or via a 24 V-signal at one of the digital inputs DI0 to DI3.
  The release is initiated with a rising edge 0 → 1 at the input an reset with a falling edge 1 → 0.

  The parameterization of the digital inputs DI0 to DI3 as hardware-gate is also done via the parameter Gate function, parameter byte 3, bits 0 to 2 (see Module parameters, page 12-85).

  A release via the hardware-gate is thus only possible if, at the same time, the control bit "Gate" in the control interface is set to 1 (software-gate, see above).

Synchronization

Synchronization must be configured before operating the counter module (see parameter Synchronization with Z). A rising edge of a reference signal at input Z is used to set the counter to the load value.

Single and **periodical** synchronization can be chosen:

The following terms have to be considered:

- The count operation has been started with the software release.
- The control bit for the release of the synchronization (SYNC_REQ) has to be set.
- During the synchronization no period duration measurement is done.
- In single synchronization, the period duration measurement starts automatically after the synchronization.

NOTE

In periodical synchronization, a period duration measurement is not possible. In this case frequency measurement has to be used!

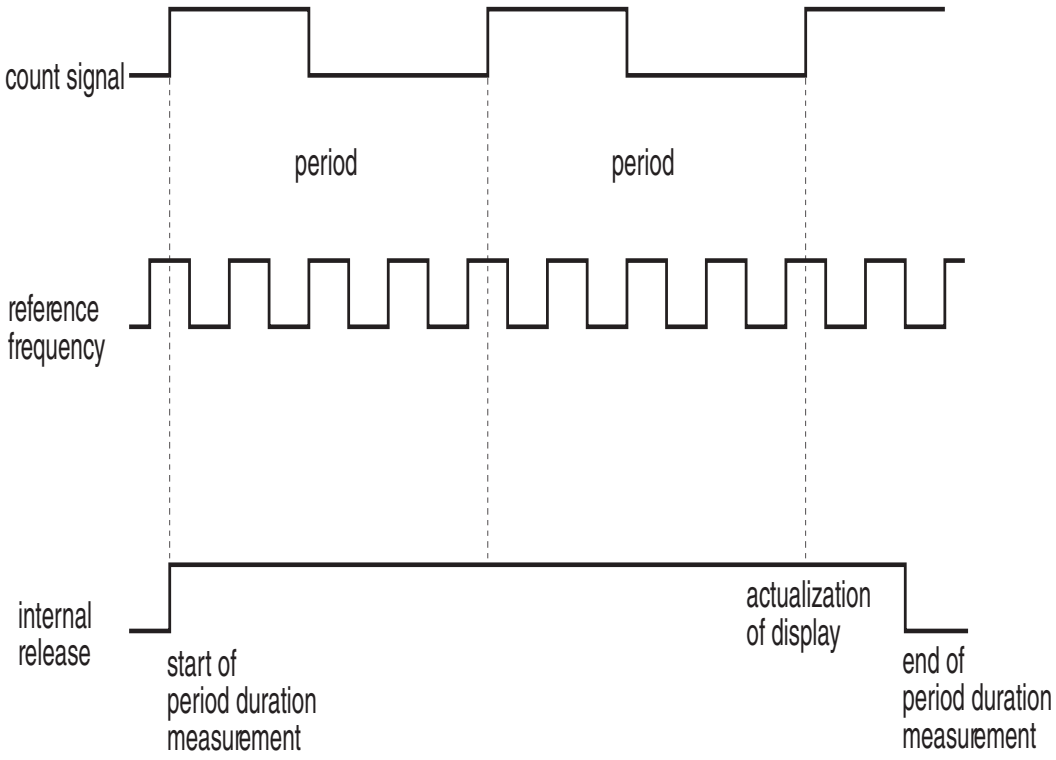
- Single synchronization:
  - Active, if parameter byte "synchronization with Z": byte 1, bit 5 = **0**.
  - In single synchronization the synchronization with the load value only takes place once with the **first** 0 → 1 rising edge at the digital input, *after* setting the release-bit.

NOTE

A synchronization with Z during frequency measurement may lead to undefined values for the time of the synchronization process.

In single synchronization, a reset and a following setting of the control bit SYNC_REQ initiates a new synchronization process. This process is started with the next rising edge 0 → 1 at the digital input.

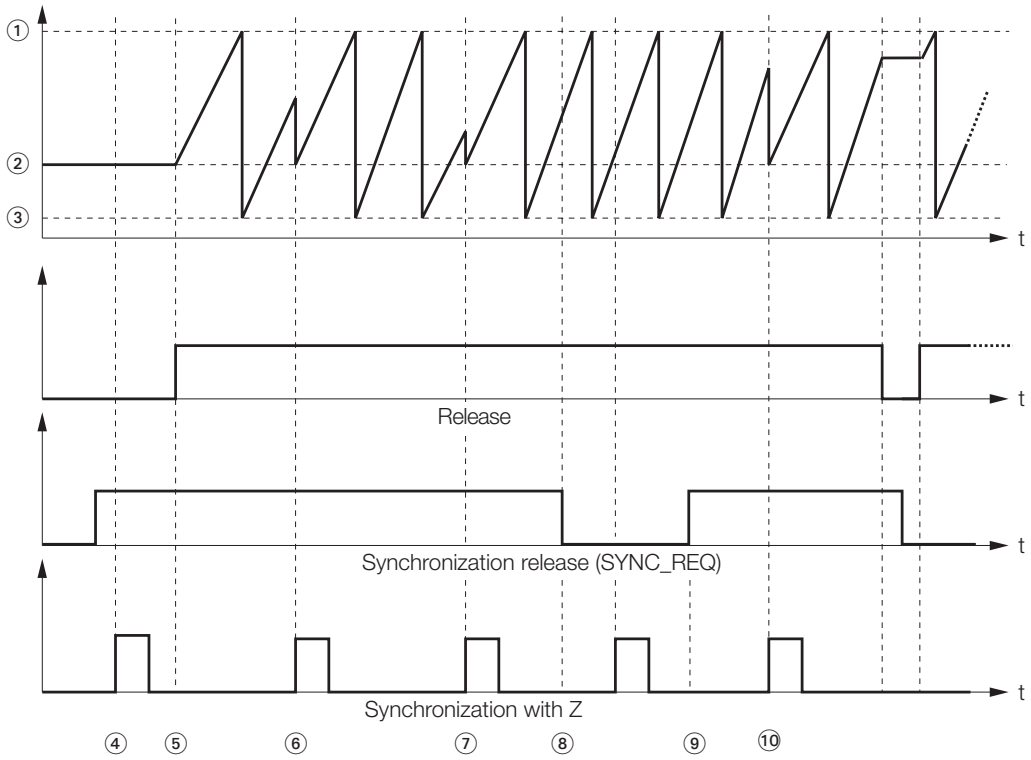
Figure 12-36: Single synchronization



1 upper count limit
2 load value
3 lower count limit
4 no synchronization without release
5 release set
6 single synchronization
7 no 2. synchronization
8 stop synchronization
9 start synchronization
10 single synchronization after new release

- Periodical synchronization:
  - Active, if parameter byte "synchronization with Z": byte 1, bit 5 = **1**.
  - In periodical synchronization, the synchronization with the load value is done with the first and every following 0 → 1 rising edge at input Z, after setting the release bit

Figure 12-37: Periodical synchronization



1 upper count limit

2 load value

3 lower count limit

4 no synchronization without release

5 release set

6 1. synchronization

7 2. synchronization

8 stop synchronization

9 start synchronization

10 1. synchronization after new release

In general, the following applies:

- After synchronization is successfully completed the SYNC_AKN status bit is set. This bit can only be reset by a new setting of the bit SYNC_REQ.

The signal of a bounce-free switch or the zero position of an encoder can be used as reference signal.

Behavior of the digital inputs DI0 to DI3

The digital input can be operated using different sensors (PNP-switch or push-pull-contact).

The input signal can be inverted.

The status-bits DI0 to DI3 display the level of the digital input.

The following functions can be selected for the digital inputs:

- Digital input
- Hardware gate (see parameter Gate function)
- Encoder GND (see parameter Function DI3).

Behavior of the digital outputs DO0 to DO3

The module provides "real" digital outputs with overload detection (see Diagnostics).

The following functions can be selected for the digital outputs:

- Digital output:
  The digital outputs are controlled via a flag in the Process data of the module, page 12-79.
- Encoder power supply (see parameter Function DO3)

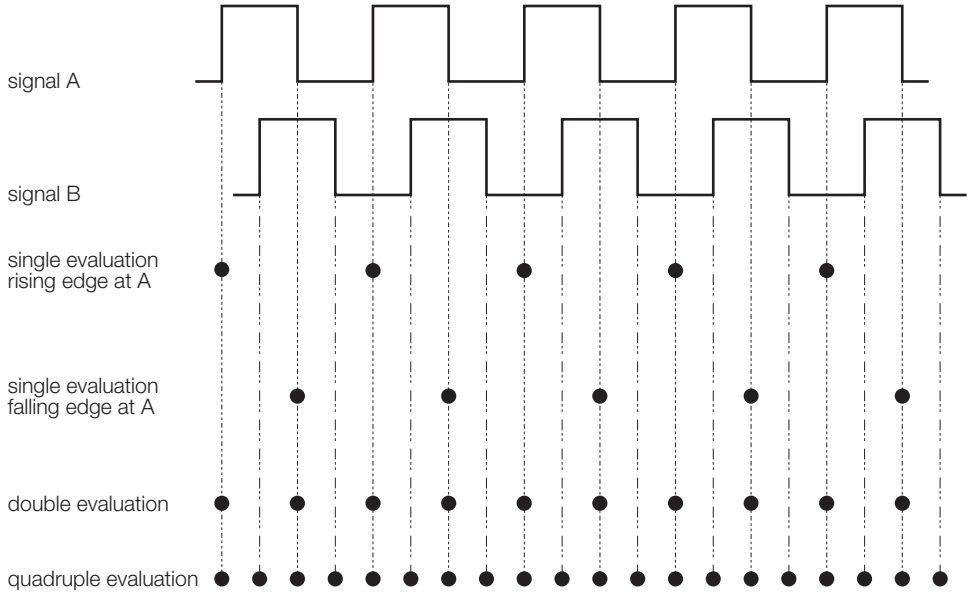
Signal-evaluation options for encoders

The setting of the evaluation options is done in the BL67 counter module. The following settings are possible:

- single
- double
- fourfold

The parameterization of the evaluation is done in parameter-byte 0, bits 2 and 3, parameter "Signal evaluation", see page 12-85.

Figure 12-38: Evaluation options for the counter module



Scan points with different evaluations

The set configuration determines how the counter status is incremented or decremented according to the rising and falling edges of signals A and B. The following evaluations are possible: The following evaluations are possible:

- Single evaluation:
  - Only the rising edge of signal A is evaluated.
    or
  - Only the falling edge of signal A is evaluated.
- Double evaluation:
  Both the rising and falling edge of signal A are evaluated.
- Fourfold evaluation:
  Both the rising and falling edge of signal A and B are evaluated.

Pulse and direction

Input A receives the counter signal and input B the direction signal.

A signal at input A can either increment or decrement the counter status depending on the state of input B.

The count direction or respectively the direction signal is parameterized in byte 1, bit 0 of the process input data (see Process input/status interface).

NOTE

The signals at A and B can be inverted.

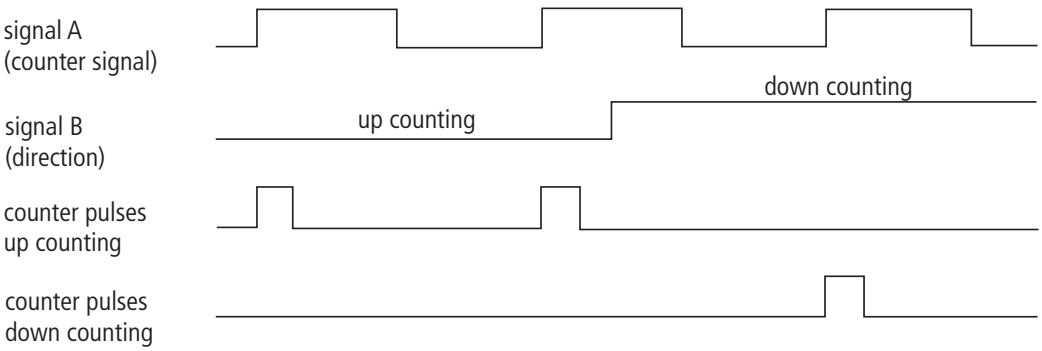


Figure 12-39: Changing the counter status on counter signal and direction signal

Load value

Load counter in preparation

The counter module can be assigned with a load value in preparation. This value can either be set via the connected controller (see Register bank of the module, register no. 40 "REG_LOAD_VALUE") or via the software I/O-ASSISTANT V3 (PACTware™ + BL67-DTM).

The preconditions for loading the load value are the following:

- a completed synchronization with Z
- a module reset

If the parameterized load value exceeds the parameterized count limits of the module, the respective count limit is loaded.

The following values can be changed using the load function during operation by means of the respective registers (see Register bank of the module):

- count value (REG_COUNTER_VALUE, register no. 32)
- lower limit (REG_LOWER_LIMIT, register no. 36)
- upper limit (REG_UPPER_LIMIT, register no. 40)
- load value (REG_LOAD_VALUE, register no. 44)
- set digital outputs
- read digital inputs

Load counter directly

The counter can be loaded directly.

In this case, the load value is directly written into the counter-value-register (register no. 0 "REG_CNT_POS", see Register bank of the module) and accepted immediately from the module as the new counter value.

If the parameterized load value exceeds the parameterized count limits of the module, the respective count limit is loaded.

12.5.5 Resetting of status bits

The reset of the status bits is initiated with a rising edge 0 → 1 at RES_STS (byte 1, bit 0) of the module's control interface Process output/control interface.

Status bits:
STS_ZC, STS_UFLW, STS_OFLW

12.5.6 Error acknowledgment

Error messages as "overload at output" (DIA_DOx) or "parameterization error" (ERR_PARA) automatically cause a diagnostic message.

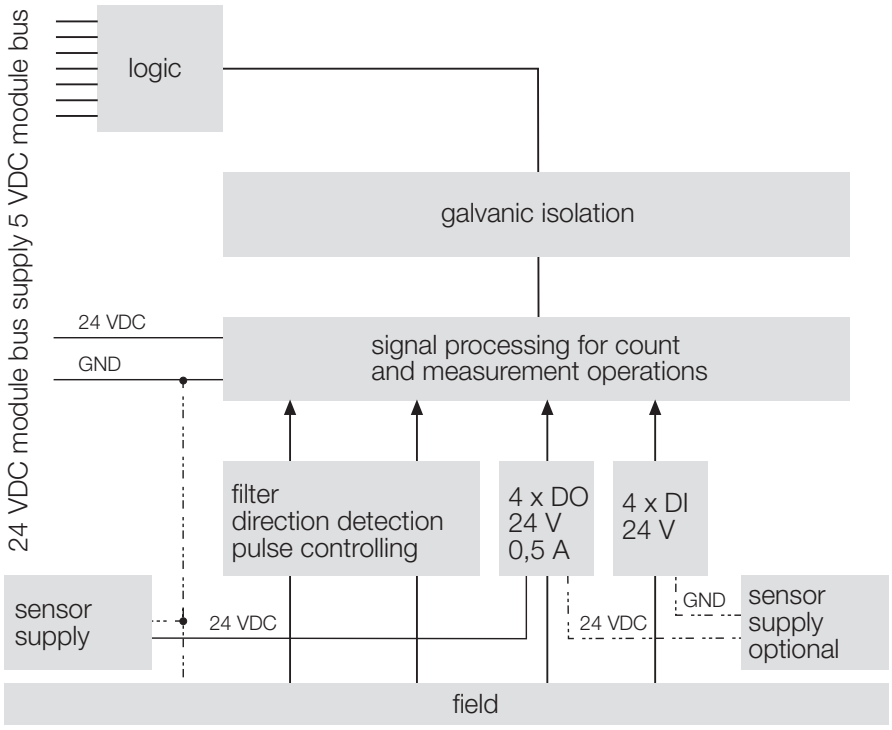
They do not have to be acknowledged. The reset of the diagnosis is done automatically after the deletion of the error.
The reset of a "ERR_PARA"-diagnostic message is done immediately after the deletion of the error, a "DIA_DOx"-diagnostic message is reset with delay, depending on the severity of the overload.

12.5.7 Technical features

Figure 12-40:
BL67-1CNT/ENC

Block diagram

Figure 12-41:
Block diagram



Technical data

Table 12-7: Technical data

Designation	BL67-1CNT/ENC
Number of channels	1
Nominal voltage from supply terminal	24 VDC
Nominal current from supply terminal I_L	< 50 mA (if load current = 0)
Nominal current from module bus I_{MB}	50 mA
Power loss of the module, typical	< 1.5 W
Sensor supply	
Output voltage of DOs	24 VDC
Output current	≤ 0.5 A short-circuit-proof
Digital inputs for counter signals A, B Z	
Differential inputs	RS422 with 150 Ω terminating resistors
– max. input voltage	acc. to RS422
Digital input with parameterizable threshold	
max. input voltage	0 to 30 VDC
U_{SE} (switching threshold)	1 to 18 V
U_{HSE} (hysteresis)	1 to 4 V
Input current	
– Low-level I_L	-0,06 to 1,1 mA
– High level I_H	0.02 mA to 2.5 mA
Minimum pulse width (maximum counter frequency)	
depends on the parameterized Input filter (A,B):	
– at 500 kHz	≥ 2 µs
– at 50 kHz	≥ 20 µs
– at 5 kHz	≥ 200 µs
Digital inputs DI0, DI1, DI2, DI3	
Input current	≤ 5 mA
Switching threshold ON	≥ 7 V
Switching threshold OFF	≤ 5 V
Digital output DO0, DO1, DO2, DO3	
Switch-on resistance R_{ON}	< 110 mΩ
Output current $_A$	
– High level $_A$ (nominal value)	0.5 A

– High-level I_{AMAX}	0.6 A (according to IEC 6 1131-2)
Switch-off characteristic K_A	
– I_{OUT} > 1.5 A	< 0.8 s
– 1,0 A < I_{OUT} > 1,5 A	< 3 s
– 0,6 A < I_{OUT} > 1,0 A	min. 3 s/max. 10 s
Simultaneity factor	100 %
Switching frequency	
with resistive load	100 Hz
with inductive load	2 Hz
with lamp load	≤ 10 Hz
Lamp load R_{LL}	≤ 10 W
Short-circuit proof	yes
Isolation voltages	
U_{TMB} (module bus/IOs)	1000 VDC
U_{field}(field/IOs)	0 VDC
U_{FE} (module bus or field/FE)	100 VDC
Measurement ranges	
Frequency measurement	250 kHz
single	max. 250 kHz
double	max. 250 kHz
fourfold	max. 125 kHz
Period duration measurement	400 ns to 858,9 s
Count modes	
signal evaluation A, B, Z	– pulse and direction – encoder, single – encoder, double – encoder, quadruple
counter mode	– continuous count – periodical count (if Synchronization with Z is parameterized as *periodical*)
synchronization	single-action periodical
Count limits	
upper count limit	0×8000 0000 to 0×7FFF FFFF Can be freely chosen, whereas the upper count limit must always be higher than the lower count limit.
lower count limit	

12.5.8 Process data of the module

Process input/status interface

	Byte	Byte in DP	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Status bytes	0	11	X	A	B	Z	DI3	DI2	DI1	DI0
	1	10	ERR_ PARA	SYNC_ AKN	X	X	X	X	X	Count direction
	2	9	REG_ WR_ ACCEPT	REG_ WR_ AKN	X	X	X	STS_ ZC	STS_ OFLW	STS_ UFLW
Communication	3	8	REG_ RD_ ABORT	REG_ACT_RD_ADR						
user data	4	7	REG_RD_DATA, byte 0							
	5	6	REG_RD_DATA, byte 1							
	6	5	REG_RD_DATA, byte 2							
	7	4	REG_RD_DATA, byte 3							
	8	3	AUX_RD_DATA, byte 0							
	9	2	AUX_RD_DATA, byte 1							
	10	1	AUX_RD_DATA, byte 2							
	11	0	AUX_RD_DATA, byte 3							

X = reserved

Table 12-8: Process input data of the module

Bit	Value	Meaning
DI0 to DI3	0	Digital input DIx = 0
	1	Digital input DIx = 1
A, B, Z	0	Digital input A, B or Z = 0
	1	Digital input A, B or Z = 1
Count direction	0	Up
	1	down
SYNC_AKN	0	Encoder not synchronized.
	1	Encoder not synchronized with zero-position.
ERR_PARA	0	The last change in parameters is valid.
	1	Faulty/inconsistent parameter data.
STS_UFLW	0	No underflow
	1	Counter value below lower limit of counter range.

Table 12-8: Process input data of the module

Bit	Value	Meaning
STS_OFLW	0	No overflow
	1	Counter value exceeded upper limit of counter range.
STS_ZC	0	No zero crossing
	1	Counter value crossed zero value.
REG_WR_AKN	0	No change in the in the registers → No command for data change in the registers by the process output. A write access (REG_WR) to the register bank is only possible when this bit was previously zero; handshake for data transfer to the registers.
	1	Register contents updated → A change in the register contents has been instructed by one process output.
REG_WR_ACCEPT	0	REG_WR_ADR error → During REG_WR = 1 the register addressed in REG_WR_ADR in the control interface could **not** successfully be written with user data.
	1	REG_WR_ADR valid → During REG_WR = 1 the register addressed in REG_WR_ADR in the control interface could successfully be written with user data.
REG_ACT_RD_ADR	0 to 127	Address of the actually read input register.
REG_RD_ABORT	0	REG_RD_ADR valid → Reading the register defined in REG_RD_ADR accepted and carried out. The register content is shown in the user data area (REG_RD_DATA, byte 0-3).
	1	REG_RD_ADR error → Reading of the register defined in REG_RD_ADR has not been accepted. The user data range (REG_RD_DATA, bytes 0-3) is zero.
REG_RD_DATA	0 to 2^{32}-1	Content of the register selected by REG_RD_ADR. If RD_ABORT = 0, if not REG_RD_DATA = 0.
AUX_RD_DATA	0 to 2^{32}-1	Content of the register which has been defined via parameter byte 14 (see Module parameters).

Process output/control interface

	Byte	Byte in DP	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Control bytes	0	7	DO3	DO2	DO1	DO0	X	X	X	GATE
	1	6	X	SYNC_ REQ	X	X	X	X	X	RES_ STS
Communication	2	5	REG_ WR	REG_WR_ADR						
	3	4	REG_RD_ADR							
user data	4	3	REG_WR_DATA, byte 0							
	5	2	REG_WR_DATA, byte 1							
	6	1	REG_WR_DATA, byte 2							
	7	0	REG_WR_DATA, byte 3							

X = reserved

Table 12-9: Process output data of the module

Bit	Value	Meaning
GATE	0	Counter inactive
	1	Counter active, depending on parameter Gate function
DO0 to DO3	0	Digital output DOx = 0
	1	Digital output DOx = 1
RES_STS	0	inactive
	1	During the change from 0 to 1 the counter status bits (STS_UFLW and STS_OFLW) are reset.
SYNC_REQ	0	no synchronization
	1	synchronization request → The bit SYNC_AKN of the status interface is reset.
REG_WR_ADR	0 to 127	Address of the register which has to be written with REG_WR_DATA.
REG_WR	0	Initial state
	1	Write register → Command to overwrite the content of register of the address REG_WR_ADR with REG_WR_DATA.
REG_RD_ADR	0 to 127	Address of the register which has to be read. If RD_ABORT = 0, the user data can be found in REG_RD_DATA in the status interface (bytes 4-7).

Table 12-9: Process output data of the module

Bit	Value	Meaning
REG_WR_DATA	0 to 2^{32-1}	Value, which has to be written to the register defined via REG_WR_ADR.

12.5.9 Diagnostic and status messages

LED status messages

Table 12-10: LED displays

LED	Display	Meaning	Remedy
DIA	Red, flashing, 0.5 Hz	Diagnostic message pending	
	Red	Module bus communication failure	Check if more than two ad-joining electronics modules have been pulled. Check the supply of the module bus.
	off	No error messages or diagnostics	–
A/Z	Green	Input A active	-
	Red	Input Z active	
	Red and green	Inputs A and Z active	
	off	Inputs A and Z inactive	
B	Green	Input B active or direction input set for down counting	-
	off	Input B inactive	-
DIO0/DIO1	Green	Channel active	-
	Red	Overload at output x	-
	off	channel inactive	
DO2/DO3	Green	Output active	
	Red	Overload at output x	
	off	Output inactive	
DI2/DI3	Green	Input active	-
	off	Input inactive	-

Diagnostics

This module has the following diagnostic data per channel:

Byte	Byte in DP	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	7	ERR_ PARA	X	X	X	X	X	STS_ OLFW	STS_ ULFW
1	6	X	X	X	X	DIA_ DO3	DIA_ DO2	DIA_ DO1	DIA_ DO0
2	5	X							
…	…								
7	0								

Table 12-11: Diagnosis of the BL67-1CNT/ENC

Diagnostic message	Value	Meaning
STS_OFLW	0	No overflow
	1	Counter value above upper limit of counter range.
STS_UFLW	0	No underflow
	1	Counter value below lower limit of counter range.
DIA_DOx	0	Output OK
	1	Short circuit or overload at output x
ERR_PARA	0	The last change in parameters is valid.
	0	Faulty/inconsistent parameter data.

Base modules

- BL67-B-1M12-8

Figure 12-42: BL67-B-1M12-8

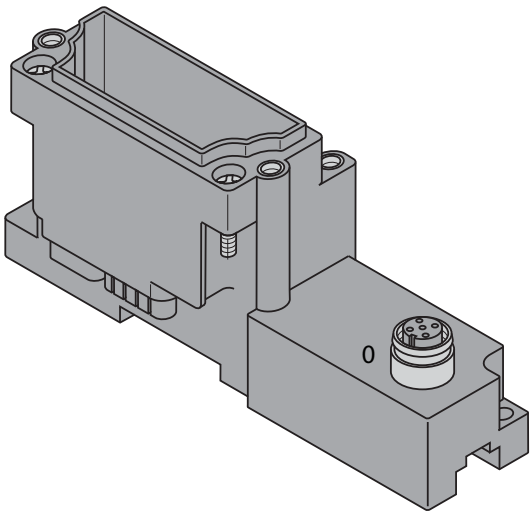
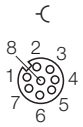


Figure 12-43: Pin assignment BL67-1CNT/ENC with BL67-B-1M12-8



1 = Di 3 / GND	5 = $\overline{B}$
2 = DO 3 / Venc	6 = $\overline{B}$
3 = A	7 = $\overline{Z}$
4 = $\overline{A}$	8 = $\overline{Z}$

- BL67-B-1M23

Figure 12-44: BL67-B-1M23

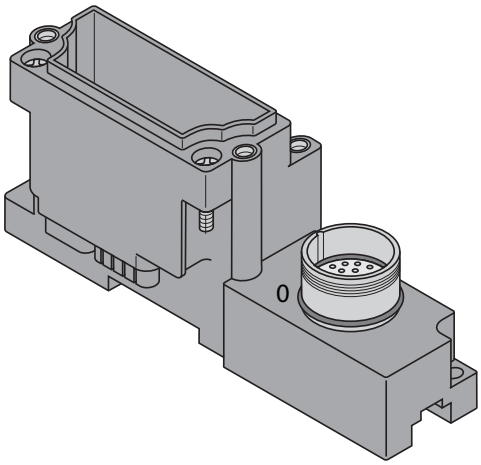


Figure 12-45: Pin assignment BL67-1CNT/ENC with BL67-B-1M23

1 = DI 3 / GND	7 = $\overline{Z}$
2 = DO 3 / Venc	8 = $\overline{Z}$
3 = A	9 = DIO 0
4 = $\overline{A}$	10 = DIO 1
5 = B	11 = DO 2
6 = $\overline{B}$	12 = GND

Figure 12-46: Pin assignment BL67-1CNT/ENC with BL67-B-1M23-VI

1 = DI 3 / GND
2 = DO 3 / Venc
3 = A
4 = $\overline{A}$
5 = B
6 = $\overline{B}$
7 = Z
8 = $\overline{Z}$
9 = V_{SENS}
10 = V_{SENS}
11 = V_{SENS}
12 = GND

12.5.10 Module parameters

Standard				PROFIBUS PROFINET		Parameter
byte-oriented		word-oriented				
Byte 0	Bit 0	Word 0	Bit 0	Byte 15	Bit 0	Input filter (A,B)
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	Signal evaluation (A,B)
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	Count direction
	Bit 5		Bit 5		Bit 5	reserved
	Bit 6		Bit 6		Bit 6	Invert input B
	Bit 7		Bit 7		Bit 7	Invert input A
Byte 1	Bit 0		Bit 8	Byte 14	Bit 0	PullUp Z
	Bit 1		Bit 9		Bit 1	Function DI3
	Bit 2		Bit 10		Bit 2	Function DO3
	Bit 3		Bit 11		Bit 3	Encoder signal
	Bit 4		Bit 12		Bit 4	reserved
	Bit 5		Bit 13		Bit 5	Synchronization with Z
	Bit 6		Bit 14		Bit 6	reserved
	Bit 7		Bit 15		Bit 7	Invert input Z
Byte 2	Bit 0	Word 1	Bit 0	Byte 13	Bit 0	Threshold input A, B, Z
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 3	Bit 0	Word 1	Bit 8	Byte 12	Bit 0	Gate function
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	Measurement mode
	Bit 4		Bit 12		Bit 4	Counter mode
	Bit 5		Bit 13		Bit 5	Invert gate
	Bit 6		Bit 14		Bit 6	reserved
	Bit 7		Bit 15		Bit 7	reserved

Standard				PROFIBUS PROFINET		Parameter
byte-oriented		word-oriented				
Byte 4	Bit 0	Word 2	Bit 0	Byte 11	Bit 0	reserved
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 5	Bit 0		Bit 8	Byte 10	Bit 0	reserved
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	
Byte 6 to Byte 13		Word 3 to Word 7		Byte 9 to Byte 2		reserved
Byte 14	Bit 0	Word 8	Bit 0	Byte 1	Bit 0	REG_AUX_ADR
	Bit 1		Bit 1		Bit 1	
	Bit 2		Bit 2		Bit 2	
	Bit 3		Bit 3		Bit 3	
	Bit 4		Bit 4		Bit 4	
	Bit 5		Bit 5		Bit 5	
	Bit 6		Bit 6		Bit 6	
	Bit 7		Bit 7		Bit 7	
Byte 15	Bit 0		Bit 8	Byte 0	Bit 0	reserved
	Bit 1		Bit 9		Bit 1	
	Bit 2		Bit 10		Bit 2	
	Bit 3		Bit 11		Bit 3	
	Bit 4		Bit 12		Bit 4	
	Bit 5		Bit 13		Bit 5	
	Bit 6		Bit 14		Bit 6	
	Bit 7		Bit 15		Bit 7	

Table 12-12: Parameters of the BL67-1CNT/ENC

A *Default setting*

Parameter name	Value	Meaning
Invert input A	0 =no **A**	Signal A not inverted
	1 = yes	Signal A inverted
Invert input B	0 =no **A**	Signal B not inverted
	1 = yes	Signal B inverted

Table 12-12: Parameters of the BL67-1CNT/ENC

Parameter name	Value	Meaning
Count direction	0 = up **A**	Counter counts up (edge A before B)
	1 = down	Counter counts down (edge B before A)
Signal evaluation (A, B)	00 = 1 x: rising edge at A	Single signal evaluation at rising edge at signal A
	01 = 1 x: falling edge at A	Single signal evaluation at falling edge at signal A
	10 = 2 x: both edges at A **A**	Single signal evaluation at rising and falling edge at signal A
	11 = 4 x: both edges at A and B	Fourfold evaluation at rising and falling edge at signal A and B (only incremental encoders)
Input filter (A,B)	00 = 500 kHz **A**	Setting the input filter for Signal A and B
	01 = 50 kHz	
	10 = 5 kHz	
	11 = reserved	
Invert input Z	0 =no **A**	Signal Z not inverted
	1 = yes	Signal Z inverted
Synchronization with Z	0 = single **A**	If a signal is pending at Z and if, at the same time, the bit SYNC_REQ = 1 (see control interface: byte 1, bit 6), then the counter is synchronized once with the load value.
	1 = periodical	If a signal is pending at Z and if, at the same time, the bit SYNC_REQ = 1 (see control interface: byte 1, bit 6), then the counter is synchronized periodically with the load value.
Encoder signal	0 = Push-pull input **A**	Push-pull input (single ended): signal evaluation between A, B, Z and GND. The inputs /A, /B and /Z are internally connected to GND.
	1 = RS422-input	RS422-input: signal evaluation between A, B, Z and /A, /B, /Z

Table 12-12: Parameters of the BL67-1CNT/ENC

Parameter name	Value	Meaning
Function DO3	0 = output **A**	The output is used as digital output.
	1 = encoder power supply	The output is used as power supply for the connected encoder.
Function DI3	0 = input **A**	The input is used as digital input.
	1 = encoder-GND	The input is used as encoder-GND.
PullUp Z	0 = 0 **A**	The PullUp-resistance for input Z is switched-off.
	1 = on	The PullUp-resistance for input Z is switched-on.
Threshold input A, B, Z	0000 = 1 V 0001 = 1.5 V 0010 = 2 V 0011 = 2.5 V 0100 = 3 V 0101 = 4 V 0110 = 5 V 0111 = 6 V 1000 = 7 V 1001 = 8 V 1010 = 9 V 1011 = 10 V **A** 1100 = 12 V 1101 = 14 V 1110 = 16 V 1111 = 18 V	Setting the threshold value for the inputs A, B and Z.
Counter mode	0 = encoder **A**	Operation mode for the connection of an incremental encoder.
	1 = pulse and direction	Operation mode for the connection of a counter with pulse- and direction-input.
Measurement mode	0 = frequency measurement **A**	Setting the measurement mode
	1 = period duration measurement	
Gate	0 =no **A**	Gate not inverted
	1 = yes	Gate inverted

Table 12-12: Parameters of the BL67-1CNT/ENC	Parameter name	Value	Meaning
	Gate function	000 = Counter permanently inactive	Selection of the hardware gate or activation of the software gate.
		001 = DI0 is HW gate	
		010 = DI1 is HW gate	
		011 = DI2 is HW gate	
		100 = DI3 is HW gate	
		101 = Z is gate	
		110 = only SW gate **A**	
		111 = reserved	
	REG_AUX_ADR	0 to 127 Default: 48	Definition of the register number from the register interface (REG_PARA; REG_COUNTER_VALUE, REG_LOWER_LIMIT etc., see page 12-92), whose content should be mapped into byte 8 - 11 of the process input data (see page 12-79).

12.5.11 Internal registers - read and write operations

This module is provided with a universal register interface that enables access to up to 128 registers.

These are accessed via the process data. For write access, it must be ensured beforehand that the register write interface is in the default status and that a write access operation is therefore not currently active.

This is ensured if REG_WR = 0 in the process output data, and is confirmed in the process input data with REG_WR_AKN = 0.

Write access is then possible. The following values must be transferred with the process output data for this:

- REG_WR_ADR = register address,
- REG_WR_DATA = value to be written (32 bit)
- REG_WR = 1 (write command)

The module acknowledges the processing of the write command via the process input data by signaling REG_WR_AKN = 1.

REG_WR_ACCEPT = 1 in the process input data confirms whether the write operation to the register was successfully completed. If the register could not be written (no access authorization, out of value range, …), this is indicated by REG_WR_ACCEPT = 0. The write operation must then be terminated by REG_WR = 0 in order to resume the default state.

The address specified at REG_RD_ADR of the process output data is used for read access. The read register content is entered in REG_RD_DATA (bytes 4-7) if the address at REG_RD_ADR was accepted in the process input data and if REG_RD_ABORT = 0 confirms that the register was read error-free.

REG_RD_ABORT = 1 indicates that the register could not be read. REG_RD_ADR in the process input data then contains the address that could not be accessed successfully. The user data is then set to ZERO.

12.5.12 Schematic diagram of the read sequence

The following diagram shows the general procedure for the read operation:

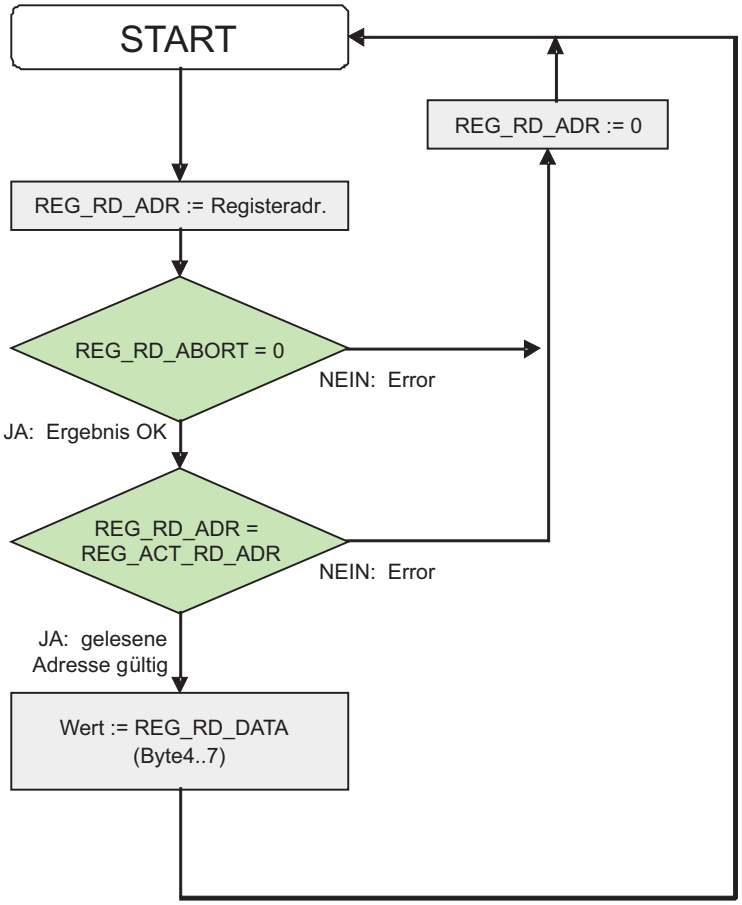


Figure 12-47: Schematic diagram of the read sequence

12.5.13 Schematic diagram of the write sequence

The following diagram shows the general procedure for the write operation:

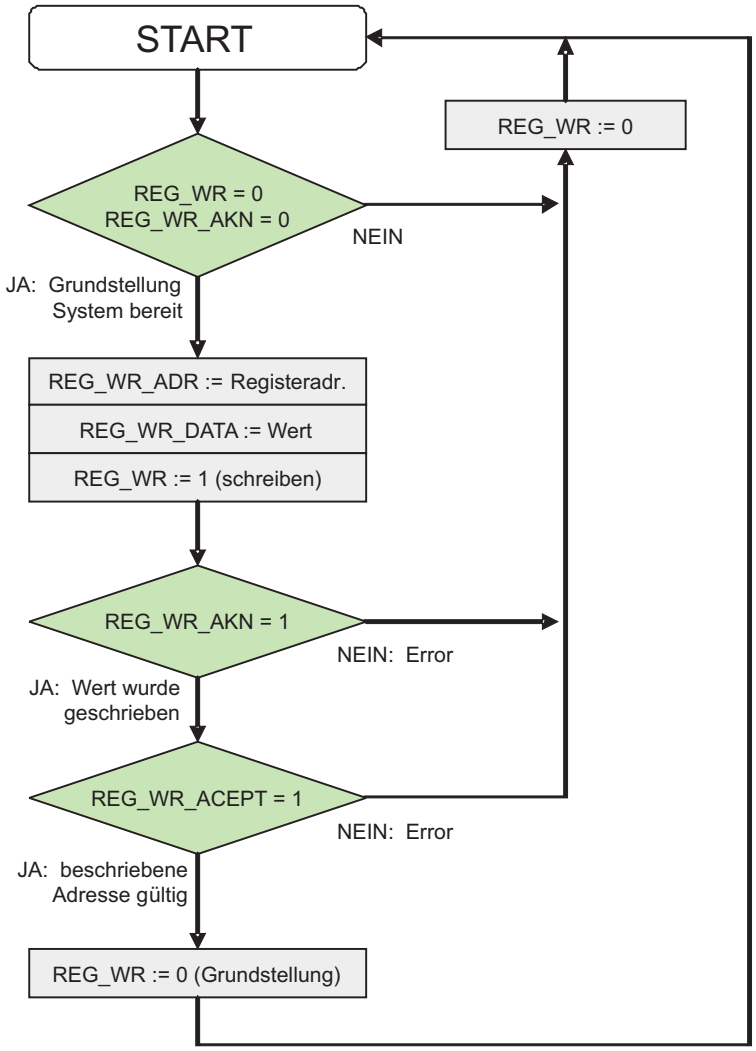


Figure 12-48: Schematic diagram of the write sequence

12.5.14 Register bank of the module

Register description and register access

Table 12-13: Register description

Designation	No.	Description	Default (HEX)
REG_CNT_POS	0	Actual count value	
REG_MAGIC_NO	1	Magic number (0xaa55cc33)	Internal use
REG_HW_VER	2	Hardware version	
REG_SW_VER	3	Firmware version	
REG_SF	4	Special Function register	
REG_IF_VER	5	Version of register interface	
	…	reserved	
REG_DIAG1	16	Diagnostics	
	…	reserved	
REG_PARA1	20	Parameter register 1	0×06 0B 00 08
	…	reserved	
REG_PARA4	23	Parameter register 4	0× 00 30 00 00
	…	reserved	
REG_COUNTER_ VALUE	32	Actual count value	
reserved	…		
REG_LOWER_LIMIT	36	Lower count limit	0×80 00 00 00
	…	reserved	
REG_UPPER_LIMIT	40	Upper count limit	0×7F FF FF FF
	…	reserved	0×0000 0000
REG_LOAD_VALUE	44	Load value	0
	…	reserved	
REG_MEASURED_ VALUE	48	Measured value of the frequency, period duration or rotation speed measurement.	
	…	reserved	
REG_SCALE_MUL	52	Multiplier for the frequency- or period duration measurement	1
	…	reserved	
REG_SCALE_DIV	56	Divisor for the frequency- or period duration measurement	1

Table 12-13: Register description

Designation	No.	Description	Default (HEX)
	…	reserved	
REG_MEASURE_TIME	60	Time out for period duration measurement/gate time for frequency measurement	100

Table 12-14: Access to the registers

Designation	Access to the interfaces RD = read WR = write					
	No.	Process output	Storage in module	Process input	Parameter	Diagnostic message
REG_CNT_POS	0			RD		
REG_MAGIC_NO	1			RD		
REG_HW_VER	2			RD		
REG_SW_VER	3			RD		
REG_SF	4			RD		
REG_IF_VER	5			RD		
REG_DIAG1	16			RD		RD
REG_PARA1	20	WR	non volatile	RD	WR	
REG_PARA4	23	WR	non volatile	RD	WR	
REG_COUNTER_VALUE	32	WR		RD		
REG_LOWER_LIMIT	36	WR	non volatile	RD		
REG_UPPER_LIMIT	40	WR	non volatile	RD		
REG_LOAD_VALUE	44	WR	non volatile	RD		
REG_MEASURED_VALUE	48			RD		
REG_SCALE_MUL	52	WR	non volatile	RD		
REG_SCALE_DIV	56	WR	non volatile	RD		
REG_MEASURE_TIME	60	WR	non volatile	RD		

NOTE

The non volatile registers can be written maximum 100.000 times.

Special function register/resetting the register bank

If the REG_SF is written with

LD20 = 0×4C443230

or

ld20 = 0×6C643230

the default values are written back to all non volatile registers (including parameter registers, Reg. 20 to 23).

If register REG_SF is written with

LD48 = 0x4C443230

or

ld48 = 0×6C643438

the default values are written back to all non volatile registers except for the parameter registers (Reg. 20 to 23).

NOTE

Values that have been overwritten are lost.

12.6 *BL ident*® - BL67-2RFID-S/BL67-2RFID-A

The description of these modules can be found in separate manuals.

The complete *BL ident*®-documentation is part of the *BL ident*®-CD:

Ident no.	Type	Document no.
1545052	BLIDENT-CD	D101659

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13.1 Mechanical mounting

13.1.1 General mounting rules

- BL67 is designed to be mounted directly at the machine.
  It can be mounted on a mounting plate or on mounting rails.
- A vertical as well as a horizontal mounting of the stations is possible.
- The complete BL67 system is secured to the mounting rail by means of two end brackets. One at each end of the station.
- The gateway is the first electronic component on a BL67 station.
- The electronic modules are mounted subsequently in the order required.
- Potential isolation can be achieved by mounting a Power Feeding module (power distribution) before mounting the next module.
- Power Feeding modules can be mounted between the rest of the modules as required.
- An end plate is mounted at the end of each BL67 station to protect the module bus contacts and to guarantee the protection class IP67.

13.2 Building up a BL67 station

NOTE

The BL67-station should be assembled completely before mounting it on a mounting plate or a mounting rail.

13.2.1 Mounting the gateway

The gateway is the first electronics component on a BL67 station.

The electronic modules are mounted on the right side of the gateway.

13.2.2 Mounting a base module

1. The module bus contacts of the first base module have to be inserted from above into the module bus contacts of the gateway.
2. Tighten the screws of the inserted base module.
3. All other base modules of the station are mounted identically. Their module bus contacts have to fit into the contacts of the respective left-hand base module.

ATTENTION!

Deficient screwing
Protection class IP67 not guaranteed
➤ Tighten the screws in the base modules correctly.

ATTENTION!

Damaged sealing
Protection class IP67 not guaranteed
➤ Check the sealing at the left module bus connector of the base modules for correct fit and damage.

13.2.3 Mounting the electronics modules

Please observe:

1 The correct base module must have been previously mounted onto the mounting rail.

2 Electronics modules are fitted onto the previously mounted and wired base modules.

NOTE

Before plugging the electronics modules, it is advisable to blow-clean the station with compressed air. This prevents dust and grains of dirt from contaminating the contacts, which can negatively influence the communication on the station.

Method:

1 Press the electronic module squarely onto the base module

2 and tighten the two screws on the top of the electronic module.

ATTENTION!

Deficient screwing
Protection class IP67 not guaranteed
➤ Tighten the screws in the base modules correctly.

ATTENTION!

Damaged sealing
Protection class IP67 not guaranteed
➤ Check the sealing t the lower side of the electronic module housing for correct fit and damage.

13.2.4 Prevention of false mounting

A mechanical coding element prevents an electronics module from being mounted onto the wrong base module – for example, following a defect in an electronics module. The coding element consists of two pieces and is supplied with every electronics module.

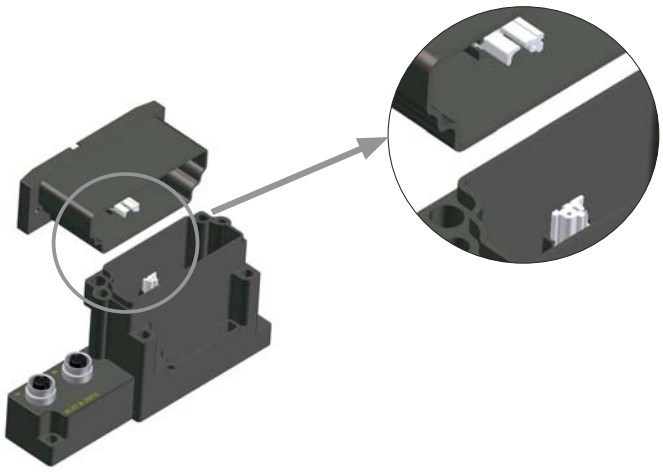
The complete coding element is mounted on the underside of each electronics module. When mounting the electronics module for the first time, the lower part of the coding element is automatically inserted into the recess provided in the base module.

NOTE

When plugging electronics modules for the first time, an initial resistance must be overcome. This is because the lower part of the coding element has to be pressed into the base module.

Should the electronics module be pulled, one half of the coding element remains in the base module, the other half remains in the electronics module. It is now possible to mount a new electronics module only when its coding matches that of the base module.

Figure 13-1: coding element



When replacing an electronics module (plugging a new electronics module), remove and dispose of the lower part of the coding element (that part destined for the base module). The original lower part of the coding element, which remains in the base module, cannot be removed.

NOTE

When all modules are mounted, the supply to the module bus should be applied to check if the station communication functions correctly (no false mounting, no empty slots, etc). The field voltage should be applied only when the correct functioning of the station has been established.

13.2.5 End plate

The end plate is mounted onto the last base module of a station. It is fixed with two screws and serves to protect the module bus contacts and to guarantee the protection class IP67.

Method:

1. Insert the end plate into the last base module of the station so that the module bus contacts of the base module are covered by the end plate.
2. Tighten both screws of the end plate.

ATTENTION!

Wrong mounting of the end plate
Protection class IP67 not guaranteed
➤ Mount the end plate correctly

ATTENTION!

Damaged sealing
Protection class IP67 not guaranteed
➤ Check the sealing at the and plate for correct fit and damage.

13.2.6 Mounting of BL67 directly on the mounting plate

The BL67 stations can be mounted directly onto a pre-drilled galvanized mounting plate. The mounting plate has to be connected to protective earth (PE).

- Fasten the station on the mounting plate by screws through the holes in the base modules and in the gateway.

13.2.7 FE connection

- The station is connected to functional earth by the FE connection at the upper right drilling of the gateway
-

NOTE

If the mounting plate is not connected to ground, the station has to be grounded via a separate ground terminal at the FE contact of the gateway.

Mounting the BL67-stations on a mounting rail

The mounting rails used for BL67 should be mounted onto a galvanized mounting plate with a minimum thickness of 2 mm/0.08 inch. This allows a reference potential for protective earth (PE) and functional earth (FE) to be created.

Please allow for a maximum distance of 150 mm/5.91 inch between mounting holes, when mounting non pre-drilled mounting rails.

1. Insert a screwdriver into the opening provided in the locking mechanism at the top of the gateway and of the base modules and open the locking mechanism of all modules in the station.
2. Tilt the top of the station towards you, position the lower groove provided on the rear of the gateway and each base module onto the lower edge of the mounting rail.
3. Tilt the top of the base module away from you and towards the mounting rail and close the locking mechanism at the gateway and every base module.
4. The station is mounted on the mounting rail.

13.2.8 Mounting end brackets

BL67 stations must be fixed securely onto the mounting rail using two end brackets.

Method:

- Clip the end bracket onto the mounting rail. If necessary, loosen the screw beforehand.
- Slide one end bracket up to the gateway and one up to the last module in the station and tighten the screws.

13.3 Dismounting a BL67 station

NOTE

The complete station should be dismounted from the mounting plate or the mounting rail before disassembling it.

13.3.1 Dismounting from the mounting rail

The BL67 stations are dismounted from the mounting plate by loosening all screws at the station.

13.3.2 Dismounting from the mounting rail

Please observe the following basic rules when dismounting:

Dismounting of a single component

- The gateway can only be dismounted from a station after all the base modules located on its right are dismounted.
- Individual base modules can only be removed from a station when all base modules located to its right have been dismounted.

CAUTION!

Electric voltage (24 V)
Danger of injury due to electric shock!
➤ Switch off all connected voltage supplies!

Dismounting an entire BL67 station in chronological order

- Disconnect the voltage at gateway and supply modules.
- Dismount electronic modules
- Disconnect wiring
- Loosen/remove end bracket and end plate
- Dismount base modules
- Dismount gateway

Dismounting electronic modules

Method:

- Loosen the screws at the front of the electronic modules and pull the electronic module away from the base module.

Dismounting the end brackets

- Loosen the screws at the end brackets and pull them away from the mounting rail.

Dismounting base modules

CAUTION!

Electric voltage (24 V)

Danger of injury due to electric shock!

➤ Switch off all connected voltage supplies!

Please observe:

- Base modules can only be dismounted from the right.
- If one base module in the middle of the station has to be changed, all other base modules on the right have to be dismounted from the mounting rail as well.

Method:

- Disconnect the wiring from the base module.
- Loosen the two screws at the front of the base modules.
- Insert a screwdriver into the opening provided in the locking mechanism at the top of the base module to be changed and of all base modules on its right.
- Pull the base modules away from the mounting rail.

Dismounting the gateway

CAUTION!
Electric voltage (24 V)
Danger of injury due to electric shock!
➤ Switch off all connected voltage supplies!

ATTENTION!
Field bus node missing
Field bus communication disturbed
➤ Separate the station from the field bus

Please observe:

- All base modules on the mounting rail must be dismounted.

Method:

- Open the locking hook at the top of the gateway by inserting a screwdriver into the opening of the locking mechanism.
- Pull the gateway away from the mounting rail.

13.3.3 Plugging and pulling electronics modules

BL67 enables the pulling and plugging of electronics modules without having to disconnect the field wiring. The BL67 station remains in operation if an electronics module is pulled.

The voltage and current supplies as well as the protective earth connections are not interrupted.

ATTENTION!
Interruption of the module bus communication
Non-defined states of in- and outputs
➤ Do not plug or pull modules under load.

CAUTION!
Plugging and pulling of modules under load
Danger due to light bows
➤ Disconnect module from load before plugging or pulling them.

14 Module labeling

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14.1 General

All electrical and electronics components for BL67 stations are supplied with labels to guarantee clear identification. In addition, Turck offers marking and labeling materials which enable individual and application specific labeling of each component. Fundamentally, the differences are as follows.

14.1.1 Colors

Each electronic module can be recognized immediately by the colored lid imprint (top and bottom).

Color identification of BL67 modules

Table 14-1: Color identification of BL67 modules

Gateway (GW)	gray
Power Feeding modules 24 VDC (PF)	gray
Digital input modules (DI)	white
Analog input modules (AI)	blue
Digital output modules (DO)	red
Analog output modules (AO)	green
Technology modules (e.g. RS232)	yellow

14.2 Designations/ident-no.

The designation is imprinted on the top of the electronic modules.

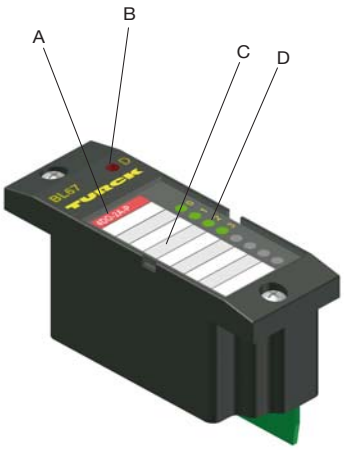
Each module is clearly identified by a Indent-number. The Indent-number as well as further module-specific details (pin assignment of the base modules, etc.) can be found on a label attached to the side of the respective module.

Figure 14-1: Module label

TURCK
BL67-8DO-0,5A-P
VN 01-06
① Vsens
③ GND
⑤ PE
OUT 0 1 2 3 4 5 6 7
4M12 0.4 1.4 2.4 3.4 0.2 1.2 2.2 3.2
4M12-P 0.4 0.2 1.4 1.2 2.4 2.2 3.4 3.2
8M8 0.4 1.4 2.4 3.4 4.4 5.4 6.4 7.4
Order No.
6827172
BNYJTU / XXXXX
Made in Germany
!Handbuch beachten! Read the manual! ▸ http://www.turck.com

Figure 14-2: labeling

A *type designation*
B *diagnosis LED*
C *label for application specific use*
D *channel-LEDs*



14.3 Channel numbering

Base module connections are numbered consecutively channel by channel.

Figure 14-3: Channel numbering

14.4 Labeling of the rotary coding switches

The labeling of the rotary coding switches for setting the field bus addresses can be found on the gateway side next to the protection cover.

Figure 14-4: Gateway labeling

14.5 Labels

Each electronics module is supplied with a label to enable application-specific identification. Labels are available as accessories.

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15.1 Nominal current consumption and power loss of the modules

NOTE

The nominal current consumption of the modules from the 24 V DC system supply at the gateway or the Power Feeding module are different for each bus system.

Please read the relevant sections in the "Appendix" of the respective gateway manual.

15.1.1 Nominal current from module bus (5 VDC) I_{MB}

Table 15-1: Nominal current from module bus

Module	Power supply	Nominal current consumption
Gateway	1500 mA	
Power distribution modules		
BL67-PF-24VDC		≤ 30 mA
Digital input modules		
BL67-4DI-P		≤ 30 mA
BL67-8DI-P		≤ 30 mA
BL67-4DI-PD		≤ 30 mA
BL67-8DI-PD		≤ 30 mA
BL67-4DI-N		≤ 30 mA
BL67-4DI-N		≤ 30 mA
BL67-16DI-P		≤ 30 mA
Analog input modules		
BL67-2AI-I		≤ 35 mA
BL67-2AI-V		≤ 35 mA
BL67-2AI-PT		≤ 45 mA
BL67-2AI-TC		≤ 35 mA
BL67-4AI-V/I		≤ 35 mA
BL67-4AI-TC		≤ 50 mA
Digital output modules		
BL67-4DO-0.5A-P		≤ 30 mA
BL67-4DO-2A-P		≤ 30 mA
BL67-4DO-4A-P		≤ 30 mA
BL67-8DO-0.5A-P		≤ 30 mA
BL67-16DO-0.1A-P		≤ 30 mA

Table 15-1: Nominal current from module bus

Module	Power supply	Nominal current consumption
BL67-4DO-2A-N		≤ 30 mA
BL67-8DO-0.5A-N		≤ 30 mA
Analog output modules		
BL67-2AO-I		≤ 40 mA
BL67-2AO-V		≤ 60 mA
BL67-4AO-V		≤ 50 mA
Relay modules		
BL67-8DO-R-NO		≤ 50 mA
Digital combi modules		
BL67-4DI4DO-PD		≤ 30 mA
BL67-8XSG-PD		≤ 30 mA
BL67-8XSG-P		≤ 30 mA
Analog combi modules		
BL67-4AI4AO-V/I		≤ 50 mA
BL67-2AI2AO-V/I		≤ 50 mA
Technology modules		
BL67-1RS232		≤ 140 mA
BL67-1RS485/422		≤ 60 mA
BL67-1SSI		≤ 50 mA
BL67-1CVI		≤ 30 mA
BL67-1CNT/ENC		< 50 mA

15.1.2 Nominal current from supply terminal (field) I_L

Table 15-2: Current consumption from supply terminal

Module	Power supply	Current consumption from supply terminal	
		from V_{sens} **A**	from V_O **B**
Gateway	-	-	-
Power distribution modules			
BL67-PF-24VDC	10 A		
Digital input modules			
BL67-4DI-P		≤ 40 mA	
BL67-8DI-P		≤ 40 mA	
BL67-4DI-PD		≤ 100 mA	
BL67-8DI-PD		≤ 100 mA	
BL67-4DI-N		≤ 1 mA	
BL67-4DI-N		≤ 1 mA	
BL67-16DI-P		≤ 3 mA	
Analog input modules			
BL67-2AI-I		≤ 12 mA	
BL67-2AI-V		≤ 12 mA	
BL67-2AI-PT		≤ 45 mA	
BL67-2AI-TC		≤ 30 mA	
BL67-4AI-V/I		≤ 12 mA	
BL67-4AI-TC		≤ 30 mA	
Digital output modules			
BL67-4DO-0.5A-P			< 100 mA **C**
BL67-4DO-2A-P			< 100 mA **C**
BL67-4DO-4A-P			< 100 mA **C**
BL67-8DO-0.5A-P			< 100 mA **C**
BL67-16DO-0.1A-P			< 100 mA **C**
BL67-4DO-2A-N			< 100 mA **C**
BL67-8DO-0.5A-N			< 100 mA **C**

A *limited by internal short circuit protection (4 A)*

B *sum of current consumptions must not exceed 10 A*

C *at load current = 0*

Table 15-2: Current consumption from supply terminal

Module	Power supply	Current consumption from supply terminal
Analog output modules		
BL67-2AO-I		≤ 50 mA
BL67-2AO-V		≤ 50 mA
BL67-4AO-V		≤ 50 mA
Relay modules		
BL67-8DO-R-NO	-	-
Digital combi modules		
BL67-4DI4DO-PD		≤ 100 mA (from V_{sens} and V_O)
BL67-8XSG-PD		≤ 100 mA (from V_{sens} and V_O)
BL67-8XSG-P		≤ 100 mA (from V_{sens} and V_O)
Analog combi modules		
BL67-4AI4AO-V/I		≤ 50 mA
BL67-2AI2AO-V/I		≤ 50 mA
Technology modules		
BL67-1RS232		≤ 50 mA
BL67-1RS485/422		≤ 25 mA
BL67-1SSI		≤ 25 mA
BL67-1CVI		< 100 mA **C**
BL67-1CNT/ENC		< 100 mA **C**

15.1.3 Maximum power loss of the modules

Table 15-3: Power loss

Module	max. power loss, typical (P_{max})
Gateway	-
Power distribution modules	
BL67-PF-24VDC	-
Digital input modules	
BL67-4DI-P	< 250 mW
BL67-8DI-P	< 250 mW
BL67-4DI-PD	< 1.5 W
BL67-8DI-PD	< 1.5 W
BL67-4DI-N	< 1.3 W
BL67-4DI-N	< 1.3 W
BL67-16DI-P	< 100 mW
Analog input modules	
BL67-2AI-I	< 1 W
BL67-2AI-V	< 1 W
BL67-2AI-PT	< 1 W
BL67-2AI-TC	< 1 W
BL67-4AI-V/I	< 1 W
BL67-4AI-TC	< 1 W
Digital output modules	
BL67-4DO-0.5A-P	< 1.5 W
BL67-4DO-2A-P	< 1.5 W
BL67-4DO-4A-P	< 1.5 W
BL67-8DO-0.5A-P	< 1.5 W
BL67-16DO-0.1A-P	< 1.5 W
BL67-4DO-2A-N	< 1.5 W
BL67-8DO-0.5A-N	< 1.5 W
Analog output modules	
BL67-2AO-I	< 1 W
BL67-2AO-V	< 1 W
BL67-4AO-V	< 1 W

Table 15-3: Power loss

Module	max. power loss, typical (P_{max})
Relay modules	
BL67-8DO-R-NO	< 2 W
Digital combi modules	
BL67-4DI4DO-PD	< 1.5 W
BL67-8XSG-PD	< 1.5 W
BL67-8XSG-P	< 1.5 W
Analog combi modules	
BL67-4AI4AO-V/I	< 1 W
BL67-2AI2AO-V/I	< 1 W
Technology modules	
BL67-1RS232	< 1 W
BL67-1RS485/422	< 1 W
BL67-1SSI	< 1 W
BL67-1CVI	< 1.5 W
BL67-1CNT/ENC	< 1.5 W

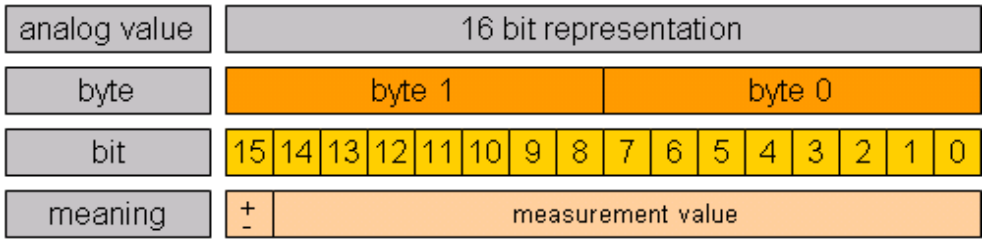
15.2 Analog value representation (analog input modules)

The analog values can either be represented with 16 bit or 12 bit. The two's-complement representation allow the representation of positive as well as negative values.

16 bit representation:

The 16-bit-representation is realized as a **two's-complement**: 2 byte of process data are completely occupied:

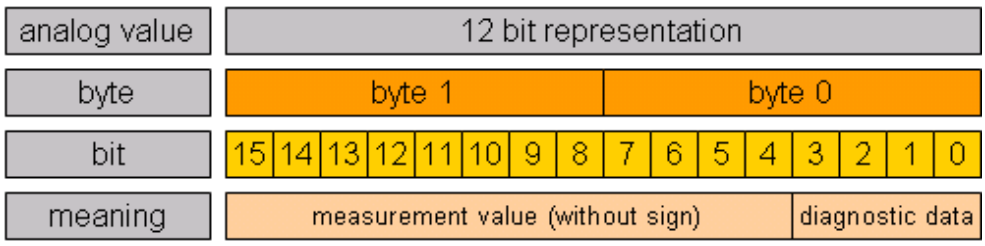
Figure 15-1: 16 bit representation



12 bit representation:

In the voltage measurement/output and in the temperature measurement, the value is represented as a two's-complement. In the current measurement/output and in the resistance measurement, the value is represented as a **dual number**. The 12 bit value is l**eft-justified** and occupies bit 15 to 4 of the process data:

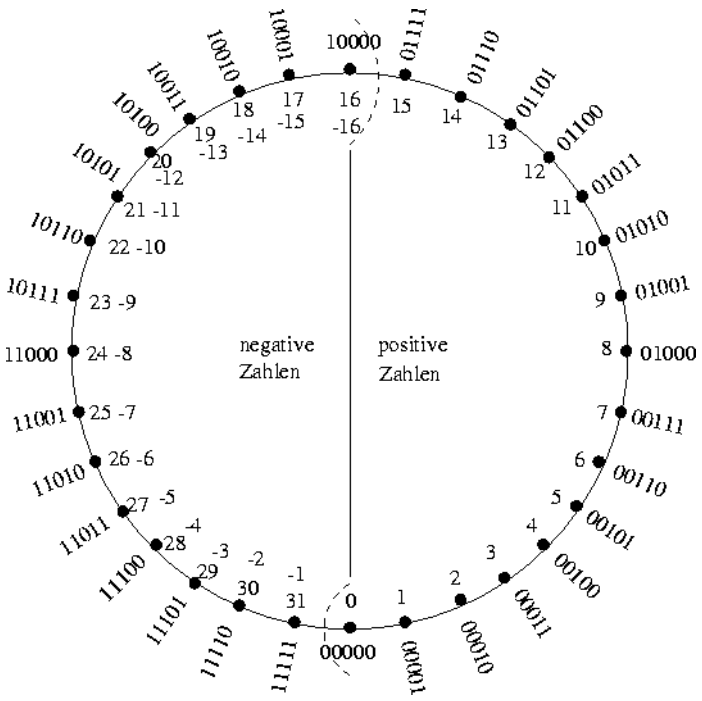
Figure 15-2: 12 bit representation



The diagnostic data is integrated in the process input data and occupies 4 bit (right-justified).

The figure shows a 5-digit binary code in the outer circuit. The inner circuit shows the respective dual number, if the binary code is interpreted as binary number (positive numerical values) and as two's complement.

Figure 15-3: Binary code as dual number ans two's complement



15.2.1 Equations for 16 bit representation

Current values from 0 to 20 mA

Before using the equation below, the hexadecimal or binary value has to be converted into a decimal value.

The value range:

0 mA to 20 mA

is displayed as follows:

0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

The hexadecimal/binary value can easily be converted into a decimal value, because all numbers belong to the positive range of the two's complement (→ page 15-9).

The current value can now be calculated by means of the following equation:

$$current\ value = \frac{dezimalerZahlenwert}{1638,\ 35}\ mA = 6{,}1 \times 10^{4} \times decimal\ value$$

Current values from 4 to 20 mA

Before using the equation below, the hexadecimal or binary value has to be converted into a decimal value.

The value range:

4 mA to 20 mA

is displayed as follows:

0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

The hexadecimal/binary value can easily be converted into a decimal value, because all numbers belong to the positive range of the two's complement (→ Figure 15-3:).

The current value can now be calculated by means of the following equation:

$current\ value = 4{,}88 \times 10^{-4} \times decimal\ value + 4\ mA$

Temperature- and resistance values (BL67-2AI-PT)

Before using the equation below, the hexadecimal or binary value has to be converted into a decimal value.

The hexadecimal/binary values for the negative value range cannot easily be converted into decimal values, because the values are coded as two's complement (→ page 15-9).

All numerical values from 00000_{hex} to $7FFF_{hex}$ represent positive values when coded as two's complement. Values in this range can easily be converted into decimal values. This is also relevant for binary numbers in which the most significant bit (bit 16) is "0".

All numerical values from 8000_{hex} to $FFFF_{hex}$ represent **negative** values when coded as two's complement. This is also relevant for binary numbers in which the most significant bit (bit 16) is "1". The conversion into a decimal number is shown in the following:

Example of the conversion of negative numerical value

The following parameterization is used in the example:

"Pt100, -200 … 150 °C"

The temperature is thus calculated with the factor 0.01 (see below).

The example explains the general procedure to convert a hexadecimal or binary number coded as two's complement to a decimal number.

The hexadecimal value should be "**B344**".

1 The binary value is

B344 ↔ **1011.0011.0100.0100**

2 Invert the binary number:

1011.0011.0100.0100 → **0100.1100.1011.1011**

3 Add a "1"to the inverted binary number:

0100.1100.1011.1011
0000.0000.0000.0001
0100.1100.1011.1100

4 Convert the binary number into a decimal number:

0100110010111100 ↔ **19644**

5 The temperature value is calculated as follows:

temperate value = 0,01 °C × decimal value = 0,01 °C × (-19644) = -19,44 °C

The temperature values can now be calculated according to the parameterization.

- For the parameterization
"Pt100, -200 … 850 °C"
"Ni100, -60 … 250 °C"
"Pt200, -200 … 850 °C"
"Pt500, -200 … 850 °C"
"Pt1000, -200 … 850 °C"
"Ni1000, -60 … 250 °C"

  use the equation:
  temperature value = 0,1°C × decimal value

The value range:

-200 °C to -0,1°C

is displayed as follows:

F830$_{hex}$ to FFFF$_{hex}$ (decimal: -2000 to -1)

The value range:

0 °C to 850 °C

is displayed as follows:

0000_{hex} to 2134_{hex} (decimal: 0 to 8500)

- For the parameterization
  "Pt100, -200 … 150 °C"
  "Ni100, -60 … 150 °C"
  "Pt200, -200 … 150 °C"
  "Pt500, -200 … 150 °C"
  "Pt1000, -200 … 150 °C"
  "Ni1000, -60 … 150 °C"

  use the equation:
  temperature value = 0,1°C × decimal value

The value range:

-200 °C to -0,01°C

is displayed as follows:

$B1E0_{hex}$ to $FFFF_{hex}$ (decimal: -20000 to -1)

The value range:

0 °C to 150 °C

is displayed as follows:

0000_{hex} to $3A98_{hex}$ (decimal: 0 to 15000)

For representation of resistance values only positive numbers (hexadecimal/binary) are used. The positive values can easily be converted into decimal ones.

The value range:

0 to 100 Ω; 0 to 200 Ω; 0 to 200 Ω; 0 to 1000 Ω

is displayed as follows:

0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

The resistance values can now be calculated according to the parameterization.

The following equations are valid:

- "Resistance, 0 … 100 Ohm":
  Resistance value = 0,00305 Ω× decimal value
- "Resistance, 0 … 200 Ohm":
  Resistance value = 0,00613 Ω× decimal value

- "Resistance, 0 … 400 Ohm":
  Resistance value = 0,01221 Ω × decimal value
- "Resistance, 0 … 1000 Ohm":
  Resistance value = 0,03052 Ω × decimal value

Temperature- and voltage values (BL67-2AI-TC)

Before using the equation below, the hexadecimal or binary value has to be converted into a decimal value.

The hexadecimal/binary values for the negative value range cannot easily be converted into decimal values, because the values are coded as two's complement (→ page 15-9).

All numerical values from 0000_{hex} to $7FFF_{hex}$ represent positive values when coded as two's complement. Values in this range can easily be converted into decimal values. This is also relevant for binary numbers in which the most significant bit (bit 16) is "0".

All numerical values from 8000_{hex} to $FFFF_{hex}$ represent negative values when coded as two's complement. This is also relevant for binary numbers in which the most significant bit (bit 16) is "1". Please see → Example of the conversion of negative numerical value, page 15-10.

The temperature and voltage values can now be calculated according to the parameterization.

- For the parameterization
  "Type K, -270 … 1370 °C"
  "Type B, +100 … 1820 °C"
  "Type E, -270 … 1000 °C"
  "Type J, -210 … 1200 °C"
  "Type N, -270 … 1300 °C"
  "Type R, -50 … 1760 °C"
  "Type S, -50 … 1540 °C"
  "Type T, -270 … 400 °C"

  use the equation:

  temperature value = **0,01 °C** × *decimal value*

The value range:

-270 °C to -0,1°C

is displayed as follows:

$F574_{hex}$ to $FFFF_{hex}$ (decimal: -2700 to -1)

The value range:

0 °C to 1820 °C

is displayed as follows:

0000_{hex} to 4718_{hex} (decimal: 0 to 18200)

The value range:

-50 mV to -0,002 mV;
-100 mV to -0,003 mV;
-500 mV to -0,015 mV;
-1000 mV to -0.031 mV

is displayed as follows:

8000_{hex} to $FFFF_{hex}$ (decimal: -32768 to -1)

The value range:

0 mV to 50 mV;
0 mV to 100 mV;
0 mV to 500 mV;
0 mV to 1000 mV;

is displayed as follows:

0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

- For the parameterization "+/50mV":
  voltage value = 0,001526 mV x decimal value
- For the parameterization "±100mV":
  voltage value = 0,003052 mV x decimal value
- For the parameterization "±500mV":
  voltage value = 0,015259 mV x decimal value
- For the parameterization "±1000mV":
  voltage value = 0,030519 mV x decimal value

Voltage values from 0 to 10 V DC

Before using the equation below, the hexadecimal or binary value has to be converted into a decimal value.

The hexadecimal/binary value can easily be converted into a decimal value, because all numbers belong to the positive range of the two's complement
(→ page 15-9).

The value range:

(0 VDC to 10 VDC

is displayed as follows:

0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

The voltage value can now be calculated by means of the following equation:

voltage value = 3,05185 mV × 10^{-4} × decimal value

Voltage values from -10 to 10 V DC

Before using the equation below, the hexadecimal or binary value has to be converted into a decimal value.

The hexadecimal/binary values for the negative value range cannot easily be converted into decimal values, because the values are coded as two's complement (→ page 15-9).

All numerical values from 0000_{hex} to $7FFF_{hex}$ represent **positive** values when coded as two's complement. Values in this range can easily be converted into decimal values. This is also relevant for binary numbers in which the most significant bit (bit 16) is "0".

All numerical values from 8000_{hex} to $FFFF_{hex}$ represent negative values when coded as two's complement. This is also relevant for binary numbers in which the most significant bit (bit 16) is "1". Please see
→ Example of the conversion of negative numerical value, page 15-10.

The value range:

-10 V to -3,052 10^{-4} V

is displayed as follows:

8000_{hex} to **$FFFF_{hex}$** (decimal:-32768 to -1)

The value range:

0 V to 10 V

is displayed as follows:

0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

voltage value = 3,05185 mV × 10^{-4} × decimal value

15.2.2 Equations for 12 bit representation

NOTE

The 12-bit-representation is "left-justified". The value is transmitted with 16 bit. The last 4 digits of the binary number or respectively the last digit position of the hexadecimal value are used as diagnostic bits!

NOTE

Before using the equation below, the hexadecimal or binary value has to be converted into a decimal value. The value is contained in the 3 more significant digit positions of the hexadecimal number or in the 12 more significant bits of the binary number.

NOTE

In the 12-bit-representation only the 3 more significant digit positions of the hexadecimal number or the 12 more significant bits of the binary number are used for the calculation of the decimal value.

Current values from 0 to 20 mA

The value range:

0 mA to 20 mA

is displayed as follows:

000_{hex} to FFF_{hex} (decimal: 0 to 4095)

The hexadecimal/binary value can easily be changed into a decimal value.

The current value can now be calculated by means of the following equation:

$current\ value = 4{,}88\ mA \times 10^{-3} \times decimal\ value$

Current values from 4 to 20 mA

The value range:

4 mA to 20 mA

is displayed as follows:

000_{hex} to FFF_{hex} (decimal: 0 to 4095)

The hexadecimal/binary value can easily be changed into a decimal value.

The current value can now be calculated by means of the following equation:

$current\ value = 3{,}91\ mA \times 10^{-3} \times decimal\ value$

Temperature- and resistance values (BL67-2AI-PT)

The hexadecimal/binary values for the negative value range cannot easily be converted into decimal values, because the values are coded as two's complement (→ page 15-9).

All numerical values from 000_{hex} to $7FF_{hex}$ represent **positive** values when coded as two's complement. Values in this range can easily be converted into decimal values. This is also relevant for binary numbers in which the most significant bit (bit 16) is "0".

All numerical values from 800_{hex} to FFF_{hex} represent negative values when coded as two's complement. This is also relevant for binary numbers in which the most significant bit (bit 12) is "1".

The conversion into a decimal number is shown in the following:
→ Example of the conversion of negative numerical value, page 15-10.

The **temperature values** can now be calculated according to the parameterization.

- The first equation is for the parameterization:
  "Pt100, -200 … 850 °C"
  "Ni100, -60 … 250 °C"
  "Pt200, -200 … 850 °C"
  "Pt500, -200 … 850 °C"
  "Pt1000, -200 … 850 °C"
  "Ni1000, -60 … 250 °C"

  temperature value = 0,5 °C × decimal value

The value range:

-200 °C to -0,5°C

is displayed as follows:

$E70_{hex}$ to FFF_{hex} (decimal: -400 to -1)

The value range:

0 °C to 850 °C

is displayed as follows:

000_{hex} to $6A4_{hex}$ (decimal: 0 to 1700)

- The second equation is for the parameterization:
  "Pt100, -200 … 150 °C"
  "Ni100, -60 … 150 °C"
  "Pt200, -200 … 150 °C"
  "Pt500, -200 … 150 °C"
  "Pt1000, -200 … 150 °C"
  "Ni1000, -60 … 150 °C"

temperature value = 0,1 °C × decimal value

The value range:

-200 °C to -0,1°C

is displayed as follows:

830_{hex} to FFF_{hex} (decimal: -2000 to -1)

The value range:

0 °C to 150 °C

is displayed as follows:

000_{hex} to $5DC_{hex}$ (decimal: 0 to 1500)

For representation of **resistance values** only positive numbers (hexadecimal/binary) are used. The positive values can easily be converted into decimal ones.

The resistance values can now be calculated according to the parameterization.

The value range:

0 Ω to 100 Ω;
0 Ω to 200 Ω;
0 Ω to 400 Ω;
0 Ω to 1000 W;

is displayed as follows:

000_{hex} to FFF_{hex} (decimal: 0 to 4095).

The following equations are valid:

- "Resistance, 0 … 100 Ohm":
  Resistance value = 0,02442 Ω× decimal value
- "Resistance, 0 … 200 Ohm":
  Resistance value = 0,04884 Ω× decimal value
- "Resistance, 0 … 200 Ohm":
  Resistance value = 0,09768 Ω× decimal value
- "Resistance, 0 … 1000 Ohm":
  Resistance value = 0,24420 Ω× decimal value

Temperature- and voltage values (BL67-2AI-TC)

Before using the equation below, the hexadecimal or binary value has to be converted into a decimal value. The value is contained in the 3 more significant digit positions of the hexadecimal number or in the 12 more significant bits of the binary number.

The hexadecimal/binary values for the negative value range cannot easily be converted into decimal values, because the values are coded as two's complement (→ page 15-9).

All numerical values from 000_{hex} to $7FF_{hex}$ represent positive values when coded as two's complement. Values in this range can easily be converted into decimal values. This is also relevant for binary numbers in which the most significant bit (bit 16) is "0".

All numerical values from 800_{hex} to FFF_{hex} represent negative values when coded as two's complement. This is also relevant for binary numbers in which the most significant bit (bit 12) is "1".

The conversion into a decimal number is shown in the following:
→ Example of the conversion of negative numerical value, page 15-10.

The temperature and voltage values can now be calculated according to the parameterization.

For the parameterization

- "Type K, -270 … 1370 °C"
- "Type B, +100 … 1820 °C"
- "Type E, -270 … 1000 °C"
- "Type J, -210 … 1200 °C"
- "Type N, -270 … 1300 °C"
- "Type R, -50 … 1760 °C"
- "Type S, -50 … 1540 °C"
- "Type T, -270 … 400 °C"

use the equation:

temperature value = 1 °C × decimal value

The value range:

-270 °C to 1820 °C

is displayed as follows:

$EF2_{hex}$ to $71C_{hex}$ (decimal: -270 to 1820)

- For the parameterization "+/50mV":
  voltage value = 0,02443 mV x decimal value
- For the parameterization "±100mV":
  voltage value = 0,048853 mV x decimal value
- For the parameterization "±500mV":
  voltage value = 0,24430 mV x decimal value
- For the parameterization "±1000mV":
  voltage value = 0,488530 mV x decimal value

The value range:

-50 mV to -0,024mV;

-100 mV to -0,049mV;

-500 mV to -0,244mV;

-1000 mV to -0,489mV;

is displayed as follows:

800_{hex} to FFF_{hex} (decimal: -2048 to -1)

The value range:

0 mV to 50 mV;

0 mV to 100 mV;

0 mV to 500 mV;

0 mV to 1000 mV;

is displayed as follows:

000_{hex} to $7FF_{hex}$ (decimal: 0 to 2047)

Voltage values from 0 to 10 V DC

The hexadecimal/binary value can easily be converted into a decimal value, because all numbers belong to the positive range of the two's complement
(→ page 15-9).

The voltage value can now be calculated by means of the following equation:

voltage value = 0,002442 x decimal value

The value range:

0 V to 10 V

is displayed as follows:

000_{hex} to FFF_{hex} (decimal: 0 to 4095)

Voltage values from -10 to 10 V DC

The hexadecimal/binary values for the negative value range cannot easily be converted into decimal values, because the values are coded as two's complement (→ page 15-9).

All numerical values from 000_{hex} to $7FF_{hex}$ represent **positive values** when coded as two's complement. Values in this range can easily be converted into decimal values. This is also relevant for binary numbers in which the most significant bit (bit 12) is "0".

All numerical values from 800_{hex} to FFF_{hex} represent **negative values** when coded as two's complement. This is also relevant for binary numbers in which the most significant bit (bit 12) is "1". Please see
→ Example of the conversion of negative numerical value, page 15-10.

The voltage value can now be calculated by means of the following equation:

For **positive** voltage values 0 VDC to 10 VDC use:

voltage value = 0,004885 x decimal value

The value range:

0 V to 10 V

is displayed as follows:

000_{hex} to $7FF_{hex}$ (decimal: 0 to 2047).

For **negative** voltage values -10 VDC to 10 VDC use:

voltage value = 0,004883 x decimal value

The value range:

-10 V to -0.0049 V

is displayed as follows:

800_{hex} to FFF_{hex} (decimal: -2048 to -1)

15.3 Analog value representation (analog output modules)

15.3.1 Resolution of analog value representations

In the bipolar mode the digitalized analog values are represented as a two's complement. The 16 bit or the 12-bit-representation (left justified) can be chosen by setting the respective module parameter.

15.3.2 Equations for 16 bit representation

Current values from 0 to 20 mA

The decimal values for the current values from 0 mA to 20 mA can be calculated by means of the following equation:

$$decimal\ value = 1638{,}35\ \frac{1}{mA} \times current\ value$$

The value range:

0 mA to 20 mA

is displayed as follows:

0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

The hexadecimal/binary value can easily be converted into a decimal value, because all numbers belong to the positive range of the two's complement
(→ page 15-9).

Current values from 4 to 20 mA

The decimal values for the current values from 4 mA to 20 mA can be calculated by means of the following equation:

$$decimal\ value = 2047{,}9375\ \frac{1}{mA} \times current\ value - 8191{,}75$$

The value range:

4 mA to 20 mA

is displayed as follows:

0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

The decimal value can easily be converted into a hexadecimal value, because all numbers belong to the positive range of the two's complement (→ page 15-9).

Voltage values from 0 to 10 V DC

The decimal values can be converted into current values from 0 VDC to 10 VDC by means of the following equation:

$$decimal\ value = 3276{,}7\ \frac{1}{V} \times voltage\ value$$

The decimal value can easily be converted into a hexadecimal value, because all numbers belong to the positive range of the two's complement (→ page 15-9).

Voltage values from -10 to 10 V DC

The decimal values can be converted into current values from -10 VDC to 10 VDC by means of the following equation:

For **positive** voltage values 0 VDC to 10 VDC use:

$$decimal\ value = 3276{,}7\ \frac{1}{V} \times voltage\ value$$

The value range:

0 V to 10 V

is displayed as follows:

0000_{hex} to $7FFF_{hex}$ (decimal: 0 to 32767)

For **negative** voltage values -10 VDC to 0 VDC use:

$$decimal\ value = 3276{,}8\ \frac{1}{V} \times voltage\ value$$

The value range:

-10 V to -3,052 10^{-4} V

is displayed as follows:

8000_{hex} to $FFFF_{hex}$ (decimal:-32768 to -1)

Conversion of the decimal values into hexadecimal/binary values

The decimal value can easily be converted into hexadecimal value. The two's complement (→ page 15-9) for the 16 bit values corresponds to the dual numbers in the positive range.

The conversion of negative decimal values into hexadecimal values is more complicated, because the values have to be coded as a two's complement. The following example explains the method of conversion:

The 4-digit hexadecimal number for the voltage value **-6 V** is searched:
Convert the value as follows, using the equation above:

$$decimal\ value = 3276{,}8\ \frac{1}{V} \times (-6\ V) = -19660{,}8$$

Some calculators can be used to convert negative decimal values directly in a hexadecimal value coded as two's complement.

Without such a calculator, convert the value as follows:

1 Convert the amount of the negative decimal value to a binary number:

$|-19600, 8| = 19660{,}8 \Leftrightarrow$ 100.1100.1100.1100

2 Fill the 16 bit of the binary number with "0":

100.1100.1100.1100 ⇔ 0100.1100.1100.1100

3 Invert the 16-digit binary number:

0100.1100.1100.1100 → 1011.0011.0011.0011

4 Add "1" to this inverted number:

1011.0011.0011.0011
0000.0000.0000.0001
1011.0011.0011.0100

5 The number is now coded as a two's complement and can be converted into a hexadecimal number.

1011.0011.0011.0100 → B334

6 The result is:

19660,8 → B334

15.3.3 Equations for 12 bit representation

NOTE

The 12-bit-representation is "left-justified". The value is transmitted with 16 bit. The last 4 digits of the binary number or respectively the last digit position of the hexadecimal value are always "0"!

Current values from 0 to 20 mA

The decimal values for the current values from 0 mA to 20 mA can be calculated by means of the following equation:

$$decimal\ value = 204{,}75\ \frac{1}{mA} \times current\ value$$

The value range:

0 mA to 20 mA

is displayed as follows:

000_{hex} to FFF_{hex} (decimal: 0 to 4095)

The decimal value can easily be changed into a hexadecimal value.

As the numbers are represented left-justified, a "0" has to be added to the 3-digit hexadecimal value or the number has to move one digit to the left.

$XXX_{hex} \rightarrow XXX0_{hex}$

The 12-digit binary number has to be filled with 4 digits of "0" or has to move 4 digits to the left:

XXXX.XXXX.XXXX → XXXX.XXXX.XXXX.0000

Current values from 4 to 20 mA

The decimal values for the current values from 4 mA to 20 mA can be calculated by means of the following equation:

$$decimal\ value = 255{,}9375\ \frac{1}{mA} \times current\ value - 1023{,}75$$

The value range:

4 mA to 20 mA

is displayed as follows:

000_{hex} to FFF_{hex} (decimal: 0 to 4095)

The decimal value can easily be changed into a hexadecimal value (see page 15-24).

Voltage values from 0 to 10 V DC

The decimal values can be converted into current values from 0 VDC to 10 VDC by means of the following equation:

$$decimal\ value = 409{,}5\ \frac{1}{V} \times voltage\ value$$

The value range:

0 V to 10 V

is displayed as follows:

000_{hex} to FFF_{hex} (decimal: 0 to 4095)

The decimal value can easily be changed into a hexadecimal value (see page 15-24).

Voltage values from -10 to 10 VDC

The decimal values can be converted into current values from -10 VDC to 10 VDC by means of the following equation:

For **positive** voltage values 0 VDC to 10 VDC use:

$$decimal\ value = 204{,}7\ \frac{1}{V} \times voltage\ value$$

The value range:

0 V to 10 V

is displayed as follows:

000_{hex} to $7FF_{hex}$ (decimal: 0 to 2047)

For **negative** voltage values -10 VDC to 0 VDC use:

$$decimal\ value = 204{,}8\ \frac{1}{V} \times voltage\ value$$

The value range:

-10 V to -0.0049 V

is displayed as follows:

800_{hex} to FFF_{hex} (decimal: -2048 to -1)

The decimal value can easily be converted into hexadecimal value. The two's complement (→ page 15-9) for the 12 bit values corresponds to the dual numbers in the positive range.

As the numbers are represented left-justified, a "0" has to be added to the 3-digit hexadecimal value or the number has to move one digit to the left page 15-24.

Conversion of the decimal values into hexadecimal/binary values

The conversion of negative decimal values into hexadecimal values is more complicated, because the values have to be coded as a two's complement. The following example explains the method of conversion:

The 4-digit hexadecimal number for the voltage value -6 V is searched:

$$decimal\ value = 204{,}8\ \frac{1}{V} \times (-6\ V) = -1228{,}8$$

Some calculators can be used to convert negative decimal values directly in a hexadecimal value coded as two's complement.

Without such a calculator, convert the value as follows:

1 Convert the amount of the negative decimal value to a binary number:
|1228, 8| = 1228,8 → 100.1100.1100

2 Fill the 12 bit of the binary number with "0":

100.1100.1100 → 0100.1100.1100

3 Invert the 12-digit binary number:

0100.1100.1100 → 1011.0011.0011

4 Add "1" to this inverted number:

1011.0011.0011
0000.0000.0001
1011.0011.0100

5 The number is now coded as a two's complement and can be converted into a hexadecimal number.

1011.0011.0100 → B34

6 As the number is represented as 16 bit left-justified, the hexadecimal value has to be completed with a "0" and the binary value with 4 "0".

B34 → B340
(1011.0011.0100 → 1011.0011.0100.0000)

7 The result is:

-1228,8 → B340

15.4 Ident codes of the BL67-modules

Each module is identified by the gateway using a unique identifier.

Table 15-4: Module ident codes

Module	ident code
Digital input modules	
BL67-4D-P	0.410030.××××
BL67-8DI-P	0.610040.××××
BL67-4D-PD	0.015630.××××
BL67-8DI-PD	0.015640.××××
BL67-4DI-N	0.420030.××××
BL67-4DI-N	0.620040.××××
Analog input modules	
BL67-2AI-I	0.225570.××××
BL67-2AI-V	0.235570.××××
BL67-2AI-PT	0.215770.××××
BL67-2AI-TC	0.215570.××××
BL67-4AI-V/I	0.417790.××××
BL67-4AI-TC	0.427790.××××
Digital output modules	
BL67-4DO-0.5A-P	0.413003.××××
BL67-4DO-2A-P	0.433003.××××
BL67-4DO-4A-P	0.453003.××××
BL67-8DO-0.5A-P	0.614004.××××
BL67-16DO-0.1A-P	0.805505.××××
BL67-4DO-2A-N	0.443003.××××
BL67-8DO-0.5A-N	0.624004.××××
Analog output modules	
BL67-2AO-I	0.220807.××××
BL67-2AO-V	0.210807.××××
BL67-4AO-V	0×427A09××
Relay modules	
BL67-8DO-R-NO	0.62004.××××
Digital combi modules	

Table 15-4: Module ident codes

Module	ident code
BL67-4DI4DO-PD	0.015633.×××
BL67-8XSG-PD	0.015744.×××
BL67-8XSG-P	0.025744.×××
Analog combi modules	
BL67-4AI4AO-V/I	0×419B99××
BL67-2AI2AO-V/I	0.217977.×××
Technology modules	
BL67-1RS232	0.014799.×××
BL67-1RS485/422	0.024799.×××
BL67-1SSI	0.044799.×××
BL67-1CVI	0×018B99×× (0×242224××) **A**
BL67-1CTN/ENC	0×019BA9××
Power distribution modules	
BL67-PF-24VDC	0.063000.×××

A *Default ID of the module → Is only transmitted if the field voltage is missing during module power-up*

15.5 Cross reference list parameters

Table 15-5: Cross reference list parameters

Parameters OLD	Parameters NEW
Digital modules	
Activate output	
0 = no 1 = yes	
Operation mode group	Activate wire break monitoring
0 = normal 1 = open-circuit monitoring	0 = no 1 = yes
Wire break	Wire break detection threshold
0000 = 0 mA 0001 = 10 mA 0010 = 20 mA 0011 = 30 mA 0100 = 40 mA 0101 = 50 mA 0110 = 60 mA 0111 = 70 mA 1000 = 80 mA 1001 = 90 mA 1010 = 100 mA 1011 = 110 mA 1100 = 120 mA 1101 = 130 mA 1110 = 140 mA 1111 = 180 mA	
Input on diagnostic	
0 = output substitute value 1 = keep last value	0 = substitute value 1 = current value
Activate input filter	
0 = no 1 = yes	

Table 15-5: Cross reference list parameters

Parameters OLD	Parameters NEW
Overcurrent	Overcurrent detection threshold
0000 = 0 mA 0001 = 10 mA 0010 = 20 mA 0011 = 30 mA 0100 = 40 mA 0101 = 50 mA 0110 = 60 mA 0111 = 70 mA 1000 = 80 mA 1001 = 90 mA 1010 = 100 mA 1011 = 110 mA 1100 = 120 mA 1101 = 130 mA 1110 = 140 mA 1111 = 180 mA	
Output on overcurrent	Output behavior at overcurrent
0 = automatic recovery 1 = controlled recovery	
Analog modules	
Range	Measurement range
0 = 0 … 10V/0 … 20 mA 1 = -10 … 10V/4 … 20 mA	
Operation mode – BL67-4AI-V/I	
0 = voltage 1 = current	
Operation mode – BL67-4AO-V – BL67-2AI2AO-V/I – BL67-4AI4AO-V/I	
0000 = voltage, -10 … 10 V standard 0001 = voltage, 0 … 10 V standard 0010 = voltage, -10 … 10 V NE43 0011 = voltage, 0 … 10 V NE43 0100 = voltage, -10 … 10 V ext. range 0101 = voltage, 0 … 10 V ext. range 1000 = current 0 … 20 mA standard 1001 = current 4 … 20 mA standard 1010 = current 0 … 20 mA NE43 1011 = current 4 … 20 mA NE43 1100 = current 0 … 20 mA ext. range 1101 = current 4 … 20 mA ext. range	
Diagnosis	Deactivate diagnostics
0 = activate 1 = deactivate	0 = no 1 = yes

Table 15-5: Cross reference list parameters

Parameters OLD	**Parameters NEW**
Element – BL67-2AI-PT	RTD type
0000 = Pt100, -200 … 850 °C 0001 = Pt100, -200 … 150 °C 0010 = Ni100, -60 … 250 °C 0011 = Ni100, -60 … 150 °C 0100 = Pt200, -200 … 850 °C 0101 = Pt200, -200 … 150 °C 0110 = Pt500, -200 … 850 °C 0111 = Pt500, -200 … 150 °C 1000 = Pt1000, -200 … 850 °C 1001 = Pt1000, -200 … 150 °C 1010 = Ni1000, -60 … 250 °C 1011 = Ni1000, -60 … 150 °C 1100 = resistance, 0 … 100 Ω 1101 = resistance, 0 … 200 Ω 1110 = resistance, 0 … 400 Ω 1111 = resistance, 0 … 1000 Ω	
Element – BL67-2AI-TC	Thermocouple type
0000 = Type K, -270 … 1370 °C 0001 = Type B, +100 … 1820 °C 0010 = Type E, -270 … 1000 °C 0011 = Type J, -210 … 1200 °C 0100 = Type N, -270 … 1300 °C 0101 = Type R, -50 … 1760 °C 0110 = Type S, -50 … 1540 °C 0111 = Type T, -270 … 400 °C 1000 = ±50 mV 1001 = ±100 mV 1010 = ±500 mV 1011 = ±1000 mV	
Element – BL67-4AI-TC	Thermocouple type
0000 = Type K, -270 … 1370 °C 0001 = Type B, +100 … 1820 °C 0010 = Type E, -270 … 1000 °C 0011 = Type J, -210 … 1200 °C 0100 = Type N, -270 … 1300 °C 0101 = Type R, -50 … 1760 °C 0110 = Type S, -50 … 1540 °C 0111 = Type T, -270 … 400 °C 1000 = ±50 mV 1001 = ±100 mV 1010 = ±500 mV 1011 = ±1000 mV 1100 = Type K -454 … 2498 °F 1101 = Type J, -346 … 2192 °F 1110 = Type C 0 … 2320 °C 1111 = Type G 0 … 2320 °C	

Table 15-5: Cross reference list parameters

Parameters OLD	Parameters NEW
Channel	Deactivate channel
0 = activate 1 = deactivate	0 = no 1 = yes
Mains suppression	
0 = 50 Hz 1 = 60 Hz	
Voltage mode (AI)	Measurement range
0 = 0 … 10 V 1 = -10 … +10	
Voltage mode (AO)	Output range
0 = 0 … 10 V 1 = -10 … +10 V	
Current mode (AI)	Measurement range
0 = 0 … 20 mA 1 = 4 … 20 mA	
Current mode (AI)	Output range
0 = 0 … 20 mA 1 = 4 … 20 mA	
Value representation	Data format
0 = Integer (15 bit + sign) 1 = 12 bit (left justified)	0 = 15 bit + sign 1 = 12 bit (left-justified)
Value representation	Data representation
00 = standard 01 = NE43 10 = extended range	
Technology modules – BL67-1RS232/BL67-1RS485/422	
Transmission rate	
0000 = 300 bps 0001 = 600 bps 0010 = 1200 bps 0100 = 2400 bps 0101 = 4800 bps 0110 = 9600 bps 0111 = 14400 bps 1000 = 19200 bps 1001 = 28800 bps 1010 = 38400 bps 1011 = 57600 bps 1100 = 115200 bps	
Data bits	
0 = 7 1 = 8	

Table 15-5: Cross reference list parameters

Parameters OLD	**Parameters NEW**
Diagnosis	Deactivate diagnostics
0 = release 1 = block	0 = no 1 = yes
Data flow control – BL67-1RS232	Data flow control
00 = none 01 = XON/XOFF 10 = RTS/CTS	
Data flow control – BL67-1RS485/422	Data flow control
00 = none 01 = XON/XOFF	
Parity bit	Parity bit
00 = none 01 = odd 10 = even	
Reduced control mode	Extended status/control mode
0 = 01:07 1 = 2:06 AM	0 = no 1 = yes
RS422/RS485	
0 = RS422 1 = RS485	
Stop bits	
0 = 1 bit 1 = 2 bit	
XOFF character	
0 – 255	
XON character	
0 – 255	
Technology modules – BL67-1SSI	
Data frame bits	
00000 to 100000	
Invalid bits (LSB)	
0000 to 1111	
Invalid bits (MSB)	
0000 to 1111	
Data rate	

Table 15-5: Cross reference list parameters

Parameters OLD	Parameters NEW
0000 = 1000000 bps 0001 = 500000 bps 0010 = 250000 bps 0011 = 125000 bps 0100 = 100000 bps 0101 = 83000 bps 0110 = 71000 bps 0111 = 62500 bps	
Data format	
0 = binary coded 1 = GRAY coded	
Sensor idle data signal test	
0 = activate 1 = deactivate	
Technology modules – BL67-1CNT/ENC	
input x	
0 = normal 1 = yes	
Input filter (A,B)	
00 = 500 kHz 01 = 50 kHz 10 = 5 kHz	
Function DI3	
00 = input 01 = encoder-GND	
Function DO3	
00 = output 01 = encoder power supply	
Encoder signal	
0 = Push-pull input 1 = RS422-input	
Measurement mode	
0 = frequency measurement 1 = period duration measurement	
PullUp Z	
0 = off 1 = on	
REG_AUX_ADR	
0 to 127	

Table 15-5: Cross reference list parameters

Parameters OLD	**Parameters NEW**
Threshold input A, B, Z	
0000 = 1V 0001 = 1.5 V 0010 = 2 V 0011 = 2.5 V 0100 = 3 V 0101 = 4 V 0110 = 5 V 0111 = 6 V 1000 = 7 V 1001 = 8 V 1010 = 9 V 1011 = 10 V 1100 = 12 V 1101 = 14 V 1110 = 16 V 1111 = 18 V	
Signal evaluation (A, B)	
00 = 1x: rising edge at A 01 = 1 x: falling edge at A 10 = 2 x: both edges at A 11 = 4 x: both edges at A and B	
Synchronization with Z	
0 = single-action 1 = periodical	
Invert gate	
0 = normal 1 = yes	
Gate function	
000 = Counter permanently inactive 001 = DI0 is HW gate 010 = DI1 is HW gate 011 = DI2 is HW gate 100 = DI3 is HW gate 101 = Z is gate 110 = only SW gate	
Counter mode	
0 = encoder 1 = pulse and direction	
Count direction	
0 = up 1 = down	

Table 15-5: Cross reference list parameters

Parameters OLD	Parameters NEW
Technology modules – BL67-1CVI	
Terminating resistor	Activate terminating resistor
0 = no terminating resistor 1 = terminating resistor active	0 = no 1 = yes
Output bits	Output data size
000 = 0 bit 001 = 4 bit 010 = 8 bit 011 = 12 bit 100 = 16 bit 101 = 24 bit 110 = 32 bit	
Transmission rate	
Transmission rate 000 = 1000 kbps 010 = 500 kbps 011 = 250 kbps 100 = 125 kbps 101 = 50 kbps 110 = 20 kbps 111 = 10 kbps	
Input bits	Input data size
000 = 0 bit 001 = 4 bit 010 = 8 bit 011 = 12 bit 100 = 16 bit 101 = 24 bit 110 = 32 bit	
Guarding	Activate guarding
0 = disabled 1 = yes	0 = no 1 = yes
Guarding time [n*0.1s]	
0 to 255	
Life Time Factor	
0 to 255	
Node	Activate node
0 = deactivate 1 = activate	0 = no 1 = yes

16 Glossary

A

Acknowledge

Acknowledgment of a signal received.

Active metal component

Conductor or conducting component that is electrically live during operation.

Address

Identification number of, e.g. a memory position, a system or a module within a network.

Addressing

Allocation or setting of an address, e. g. for a module in a network.

Analog

Infinitely variable value, e. g. voltage. The value of an analog signal can take on any value, within certain limits.

Attribute

Attributes represent the data that a device makes available via the DeviceNet fieldbus (e. g. status of an object, serial number of the device, process data).

Automation device

A device connected to a technical process with inputs and outputs for control. Programmable logic controllers (PLC) are a special group of automation devices.

B

Baud

Baud is a measure for the transmission speed of data. 1 Baud corresponds to the transmission of one bit per second (Bit/s).

Baud rate

Unit of measurement for data transmission speeds in Bit/s.

Bidirectional

Working in both directions.

Bit Strobe

A Bit Strobe I/O connection is a connection between a DeviceNet client and an undetermined number of servers, these being queried by commands sent by the client.

Bonding strap

Flexible conductor, normally braided, that joins inactive components, e. g. the door of a switch gear cabinet to the cabinet main body.

Bus

Bus system for data exchange, e. g. between CPU, memory and I/O levels. A bus can consist of several parallel cables for data transmission, addressing, control and power supply.

Bus cycle time

Time required for a master to serve all slaves or stations in a bus system, i. e. reading inputs and writing outputs.

Bus line

Smallest unit connected to a bus, consisting of a PLC, a coupling element for modules on the bus and a module.

Bus system

All units which communicate with one another via a bus.

C

Capacitive coupling

Electrical capacitive couplings occur between cables with different potentials. Typical sources of interference are, e. g. parallel-routed signal cables, contactors and electrostatic discharges.

Coding elements

Two-piece element for the unambiguous assignment of electronic and base modules.

Configuration

Systematic arrangement of the I/O modules of a station.

Control interface

The control interface is the interface from the BL67's internal module bus to the counter module. The commands and signals directed to the counter module are converted by the BL67 gateway from the respective type of communication applicable to the fieldbus in to the module-specific bits and bytes.

COS

Change of State Connections are event controlled connections. This means the DeviceNet devices generate messages as soon as a change of state takes place.

CPU

Central Processing Unit. Central unit for electronic data processing, the processing core of the PC.

Cyclic

Messages are triggered time-controlled in Cyclic I/O connections by means of a time generator.

D

Digital

A value (e. g. a voltage) which can adopt only certain statuses within a finite set, mostly defined as 0 and 1.

DIN

German acronym for German Industrial Standard.

E

EDS

Electronic Device Data Sheet which contains standardized DeviceNet station descriptions. They simplify the planning of the DeviceNet nodes.

EIA

Electronic Industries Association – association of electrical companies in the United States.

Electrical components

All objects that produce, convert, transmit, distribute or utilize electrical power (e. g. conductors, cable, machines, control devices).

EMC

Electromagnetic compatibility – the ability of an electrical part to operate in a specific environment without fault and without exerting a negative influence on its environment.

EN

German acronym for European Standard.

ESD

Electrostatic Discharge.

F

Field power supply

Voltage supply for devices in the field as well as the signal voltage.

Fieldbus

Data network on sensor/actuator level. A fieldbus connects the equipment on the field level. Characteristics of a fieldbus are a high transmission security and real-time behavior.

Force Mode

Software mode which enables the user to set his plant to a required state by forcing certain variables on the input and output modules.

G

GND

Abbreviation of ground (potential "0").

Ground

Expression used in electrical engineering to describe an area whose electrical potential is equal to zero at any given point. In neutral grounding devices, the potential is not necessarily zero, and one speaks of the ground reference.

Ground connection

One or more components that have a good and direct contact to earth.

Ground reference

Potential of ground in a neutral grounding device. Unlike earth whose potential is always zero, it may have a potential other than zero.

H

Hexadecimal

System of representing numbers in base 16 with the digits 0…9, and further with the letters A, B, C, D, E and F.

Hysteresis

A sensor can get caught up at a certain point, and then "waver" at this position. This condition results in the counter content fluctuating around a given value. Should a reference value be within this fluctuating range, then the relevant output would be turned on and off in rhythm with the fluctuating signal.

I

I/O

Input/output.

Impedance

Total effective resistance that a component or circuit has for an alternating current at a specific frequency.

Inactive metal components

Conductive components that cannot be touched and are electrically isolated from active metal components by insulation, but can adopt voltage in the event of a fault.

Inductive coupling

Magnetic inductive couplings occur between two cables through which an electrical current is flowing. The magnetic effect caused by the electrical currents induces an interference voltage. Typical sources of interference are for example, transformers, motors, parallel-routed network and HF signal cables.

Intelligent modules

Intelligent modules are modules with an internal memory, able to transmit certain commands (e. g. substitute values and others).

L

Load value

Predefined value for the counter module with which the count process begins.

Lightning protection

All measures taken to protect a system from damage due to overvoltages caused by lightning strike.

Low impedance connection

Connection with a low AC impedance.

LSB

Least Significant Bit

M

Mass

All interconnected inactive components that do not take on a dangerous touch potential in the case of a fault.

Master

Station in a bus system that controls the communication between the other stations.

Master/slave mode

Mode of operation in which a station acting as a master controls the communication between other stations in a bus system.

Module bus

The module bus is the internal bus in a BL67 station. The BL67 modules communicate with the gateway via the module bus which is independent of the fieldbus.

MSB

Most Significant Bit

Multi-master mode

Operating mode in which all stations in a system communicate with equal rights via the bus.

N

Namur

German acronym for an association concerned with standardizing measurement and control engineering. Namur initiators are special versions of the two-wire initiators. Namur initiators are characterized by their high immunity to interference and operating reliability, due to their special construction (low internal resistance, few components and compact design).

O

Overhead

System administration time required by the system for each transmission cycle.

P

PLC

Programmable Logic Controller.

Potential compensation

The alignment of electrical levels of electrical components and external conductive components by means of an electrical connection.

Potential free

Galvanic isolation of the reference potentials in I/O modules of the control and load circuits.

Potential linked

Electrical connection of the reference potentials in I/O modules of the control and load circuits.

Protective earth

Electrical conductor for protection against dangerous shock currents. Generally represented by PE (protective earth).

R

Radiation coupling

A radiation coupling appears when an electromagnetic wave hits a conductive structure. Voltages and currents are induced by the collision. Typical sources of interference are e. g. sparking gaps (spark plugs, commutators from electric motors) and transmitters (e. g., radio), that are operated near to conducting structures.

Reaction time

The time required in a bus system between a reading operation being sent and the receipt of an answer. It is the time required by an input module to change a signal at its input until the signal is sent to the bus system.

Reference potential

Potential from which all voltages of connected circuits are viewed and/or measured.

Repeater

Amplifier for signals transmitted via a bus.

Root-connecting

Creating a new potential group using a power distribution module. This allows sensors and loads to be supplied individually.

RS 485

Serial interface in accordance with EIA standards, for fast data transmission via multiple transmitters.

S

Serial

Type of information transmission, by which data is transmitted bit by bit via a cable.

Setting parameters

Setting parameters of individual stations on the bus and their modules in the configuration software of the master.

Shield

Conductive screen of cables, enclosures and cabinets.

Shielding

Description of all measures and devices used to join installation components to the shield.

Short-circuit proof

Characteristic of electrical components. A short-circuit proof part withstands thermal and dynamic loads which can occur at its place of installation due to a short circuit.

Station

A functional unit or I/O components consisting of a number of elements.

T

Terminating resistance

Resistor on both ends of a bus cable used to prevent interfering signal reflections and which provides bus cable matching. Terminating resistors must always be the last component at the end of a bus segment.

To ground

Connection of a conductive component with the grounding connection via a grounding installation.

Topology

Geometrical structure of a network or the circuitry arrangement.

U

UART

Universal Asynchronous Receiver/Transmitter. UART is a logic circuit which is used to convert an asynchronous serial data sequence to a parallel bit sequence or vice versa.

Unidirectional

Working in one direction.

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